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SOCIETY FOR ADVANCEMENT OF MANAGEMENT SAM

VOLUME XX NO. 4

In This Issue . . .

Some Special Characteristics Of Successful Management
Joseph M. Dodge

Break-Even Analysis And The Measurement Of Capital Productivity
Joel Dean

Operations Research And Management Problems
Wroe Alderson

Small Business And Scientific Management
Philip Rauch

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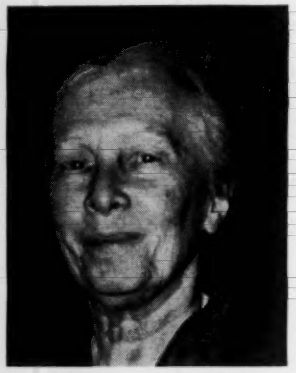

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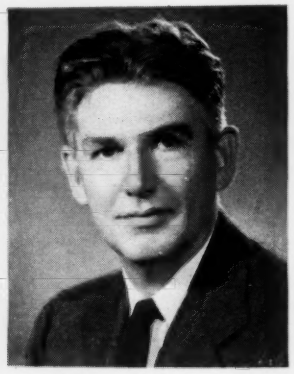

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ADVANCED MANAGEMENT, published monthly by the Society for the Advancement of Management, Inc., 74 Fifth Avenue, New York 11, N. Y., is merged with MODERN MANAGEMENT, and is successor to The Society for the Advancement of Management Journal, the Bulletin of the Taylor Society and of The Society of Industrial Engineers. Re-entered as second-class matter, December 23, 1949, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Copyright, 1954 Society for Advancement of Management. Subscription rate: $8.00 per year. Single copies: 75 cents (members); $1.00 (non-members). An index to ADVANCED MANAGEMENT is published annually, and the contents are also indexed in Industrial Arts Index which is available at Public Libraries. Notification of address changes must be given at least four weeks in advance.

"Through research, discussion, publication, and other appropriate means to conduct and promote scientific study of the principles governing organized effort in industrial and economic life . . . for the general betterment of society . . ."

SAM Constitution

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Nominees For SAM National Officers 1955-56

The SAM Nominating Committee met personally in New York City to consider the suggestions of the chapters for the four elected positions. The National Board of Directors will elect the President, Executive Vice-President, Treasurer, and Secretary at its annual policy meeting in April. Although this slate of the Nominating Committee has been well thought out as to its ability to meet the objectives of SAM and work together as a team, the National Directors may present other nominations from the floor at the April meeting. The by-laws provide that such nominations can be made in a petition signed by ten National Directors.

When the Nominating Committee met in January, at the SAM office in New York, the five members first determined the ideal qualifications for officers of our Society. No names were discussed until this step was accomplished. We had the benefit of the thinking of former members of the Nominating Committee and of others who could judge our job objectively.

One fundamental appeared over and over again. The Executive Vice-President, the Treasurer, and the Secretary should be potentially qualified as the chief executive of SAM. In no other way can the ultimate President get sufficient experience in handling the national affairs of the Society. However, it was just as obvious that the Nominating Committee should not consider that there is any automatic promotion of officers once elected. There must be freedom to select the most qualified President and his supporting group of officers.

Most of the chapters made recommendations to the committee, and every name was thoroughly considered. As a by-product of this excellent work by the chapters, the officers for next year will have a good list of members to be considered for appointments to committees and as chairmen and officers. This list will be important to the officers in bringing new talent and ability into national activities.

The Nominating Committee proposes the following slate of officers for 1955-56 as a most capable group of executives to direct the national responsibilities of SAM:

President—FRANCIS F. BRADSHAW (N. Y. Chapter)
Executive Vice-President—JOHN B. JOYNT (Asheville Chapter)
Treasurer—HOMER E. LUNKEN (Cincinnati Chapter)
Secretary—DAUSE L. BIBBY (Binghamton Chapter)

Our committee has the assurance that each candidate has accepted the responsibility with the good will of his company. There is much time and work involved in these positions, and the company's support is vital if the officer's performance is to be satisfactory.

Our committee strongly believes that this slate will work well as a team to have SAM serve its members better and, in turn, the business community to which SAM is ultimately responsible.

Respectfully submitted,

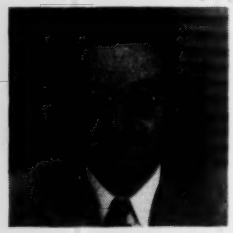
BRUCE PAYNE, Chairman
J. RICHARD JEFFREY (Columbus)
EARL HAVNER (Boston)
PAUL MACCUTCHEON (Raritan Valley)
WARREN MELLIN (Clearing)

The above report is published in accordance with the by-laws of the Society.

JAMES E. NEWSOME, Secretary

President: Francis F. Bradshaw
N. Y. Chapter

Organizer and President of Richardson, Bellows, Henry & Company, management consultants. For twenty-five years a dean at the University of North Carolina. One of the originators of the Army Specialized Training and Navy V-12 Programs. Doctorate in Psychology, Columbia University. Has lectured at University of North Carolina, Columbia, Cornell, Rutgers, Dartmouth, and Stanford. Currently Executive Vice-President of SAM and a Director of the Council for International Progress in Management.



Executive Vice-President: John B. Joynt
Asheville Chapter

Manager of the Administrative Engineering Department, American Enka Corporation. Well known in management fields and has held positions with manufacturing, banking, and transportation companies. Holder of the Legion of Merit for exceptional military service while on the Management Control staff of General Somervell. National Treasurer of SAM, Member of NOMA, Director of Systems and Procedures Association of America, Fellow of AMA in Organization Planning.

Treasurer: Homer E. Lunken
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Secretary: Dause L. Bibby
Binghamton Chapter

Vice-President, International Business Machines Corporation. Graduate of University of Texas; with IBM since 1934. Now in charge of all card operations. During World War II, Mr. Bibby was given a leave of absence to enter the Navy as a Lieutenant and during his Naval career he served as a Special Officer to the Chief of the Bureau of Supplies and Accounts in Washington. His special assignments took him to various military installations in the United States and island bases in the Pacific area. Mr. Bibby was one of the men responsible for the organization of the Binghamton, New York Chapter and has continued to serve actively as Director of the Chapter.

JOSEPH M. DODGE, currently Special Assistant to the President of the U. S. and Chairman of the Council on Foreign Economic Policy, has held many government posts in recent years, among them the job of Consultant to the Secretary of State on Financial and Economic Problems relating to Japan (1952-53), Financial Consultant to the Army (1949-53), Member of the Advisory Committee on Fiscal and Monetary Problems of the ECA (1948-51), Chairman of the Price Adjustment Board, Central Procurement District, Army Air Forces (1942-43). Mr. Dodge was vice president and assistant to the Chairman of the Board of First National Bank, Detroit (1932-33); President, Director and Chairman of The Detroit Bank (1933-53). Since 1954 he has served as Director and Chairman of The Detroit Bank.

Some Special Characteristics Of Successful Management

By Joseph M. Dodge
Director and Chairman
The Detroit Bank
Detroit, Michigan

Time has produced a substantial and fundamental change in the responsibilities and relationships of management. The development of larger and larger business units; the greater complexity of their operations; ownership represented by equity investment interests, which have little or no direct contact with the business itself; and their related changes have created the need for a more professional management group. This article examines the qualities of this new group.

As you all know there was a time when the manager of a business usually was its proprietor. He conducted it according to his own ideas, and he learned mostly from personal experience. If the business was successful, he was well paid. If it failed, he took the sacrifice in personal income and capital. Today, this type of operation generally is true only of the comparatively small business enterprise.

The modern business manager does not pay for mistakes with his own money but with the money of other people who may not easily accept the results of costly errors in judgment or in operations.

To meet the problems requiring a broader knowledge and understanding of business processes and relationships, there has been a gradual increase of academic training in the fundamentals of business operation, finance, economics, and management. Most of our universities now have specialized courses directed toward the development of managerial talent. A natural corollary of this has been the creation of a substantial literature about management in which men of experience, success, and special knowledge contribute what they have learned for the benefit of those with management objectives.

The importance of this study to business and to success in business is emphasized by the demand for trained men, by the growth of the enrollment in specialized business courses and, even more so, by the fact that industry has integrated continued management training into its daily operations.

My purpose is to present a few of the aspects of management at work that I have learned and observed in some thirty years' experience as an executive. I intend to speak about some of the special characteristics of successful managers, not usually discussed in text books.

I will comment briefly on the common knowledge of the need for a thorough understanding of the place and function of each element of the operating mechanism of a business. This is an essential but more technical knowledge, and is a subject related most closely to operations and production.

Everyone knows, or should, that effective performance requires the coordination of each part with every other part. The gears on which the operation and its results depend must be in mesh, they must move at properly related speeds; and must be under constant inspection and close control to prevent interferences, distortions of alignment, and unequal performance.

In the general management of an enterprise, production and costs, sales and prices, investment and finance, and public and labor relations all have to be coordinated into an overall favorable result. None are minor problems any way you measure them. Each requires highly specialized skills. Each is a part of the function of management. And each requires the application of management principles at many levels.

The first special characteristic is this. I believe successful management is as much a matter of a sound personal philosophy as it is of operating knowledge or techniques. This will be composed of tested and constructive fundamental principles of management that serve as a guide and support in the implementation of the multiple aspects of management's duties and relationships. These principles are not easily acquired. They are not something that can be bought or obtained, fully pre-

A talk made before the Detroit Chapter of SAM.

pared for use. They are the product of intelligent observation, understanding, and appreciation of all the external and internal forces that come to focus in conducting a business enterprise.

Experience Valuable If It Helps Growth

The second point is that ability to function successfully as a manager is not necessarily a product of technical knowledge or working experience. It is true that experience is a valuable personal asset, but only if the individual has the capacity to learn from experience, and apply what he has learned to the constructive benefit of himself and the business. We all know every business has individuals with long service of real value whose competence at this work adds up to a substantial contribution. In many respects these people are the backbone of the business. But for one reason or another, often there is an inability to turn that experience into an asset which substantially furthers personal progress into the realm of management.

The best example of this is in the story of a man who did not receive advancement into an executive position. He went to the president of his company and complained about the lack of consideration given to him. With appropriate emphasis, he referred to his many years of experience which he claimed the management had completely disregarded.

The president said, "I am sorry you brought that up, but you have made it necessary for me to answer. It is true you have been with this business for many years, but I regret to say you have not had as many years of experience as you think. Actually, you have merely repeated one year of experience—over and over—many times."

I suggest that the primary test of every individual approaching or actually in the area of management is a relatively simple one. It is in an attitude of mind and in an ability constantly to raise his level of thinking about himself, about his job, about his relationship to the business and to his associates, and about the relationship of the business to the public.

At the very lowest level is the individual whose habits of thought are based on the movies, the television, the funny papers, and the date he had last night or is going to have tomorrow night. Even while he works his thoughts are centered on himself and on personal interests unrelated to his work.

These habits of thinking move on up through various easily defined stages to the man who, at least while he is working, puts his mind on his job; the man who competes with himself and with everyone else to see how well he can do his work; and the man who strives to understand what he is doing and why, and the relationship of what he does to the work of other people. Finally, the man who learns to think less in personal terms and more in terms of the needs of the business may reach the executive or directing level and, ultimately, the administrative level which deals primarily with policy.

I have observed that one outstanding characteristic of the earliest stages of management development is a combination of ambition, ability, and a sense of obligation. The man who would rate management consideration demonstrates a desire and a capacity to make a greater-than-average contribution. He finds ways and means to make larger payments into his job account than others, or than may be expected from him. I have heard Mr. K. T. Keller, of the Chrysler Corporation, refer to such a man as an "accomplishment worker" rather than a "money worker"—a very apt description.

In its later stages, these attributes are developed into an ability to operate as an owner, but with the full realization that he does so as a trustee for stockholders, for employees, and for the public.

Objectives Must Include Community Welfare

Today, management has to embody within its objectives a full consideration of their social effects. Included in this is the principle of operating a business that is sound and will be permanent; one that makes a definite contribution to the welfare and stability of the community; and one that does not bring unnecessary hazards to its owners, its management, and its staff.

If this principle is applied, the approach can not be one which measures actions or policies primarily in terms of self-interest. It is a mere matter of fact that, under the conditions of today, the completely selfish man can not be a permanent success as a manager or make a permanent success of a business.

If you will consider this suggestion about the level of thinking and the motives of individuals, I believe you will find in it the key to most of your judgments about their possibilities and the measure of responsibility which can be entrusted to them.

Ability To Make Best Choice Vital Quality

The next important requirement is that of good judgment. Some people call it wisdom; a combination of knowledge and the capacity to use it. I have another more practical and more easily defined word which is "selectivity"—the insight and the ability to make the best choice under the circumstances. Whatever you may choose to call it, it is vital.

Unfortunately, some apparently intelligent, well educated individuals never seem to demonstrate good judgment. Occasionally they are defeated by their education. There is extensive knowledge, but little sense of its practical uses, except perhaps to antagonize other people by a desire to display superiority. And, sometimes, individuals are too intelligent to see simple things simply.

You may have observed that, while there are important places and uses for extensive knowledge and extraordinary intelligence, few successful managers could qualify as superior intellectual types. Their knowledge and intelligence are demonstrated by an earthly, realistic, and practical interpretation of men, circumstances, and events. While recognizing the values of theory, the manager has to become an expert in its practical application.

Few realize how much business success and progress depend on this element of selectivity as an ability of management. It might be defined as a cultivated sense of discrimination, which is the real objective of education. It is the ability to perceive the best ends and the best means to those ends; to distinguish between what is effective and what is ineffective, what is necessary and what is unnecessary, what is important and what is unimportant, what should be done now and what should be done later, and the like. But also it enters into practically every day-to-day decision of a manager. It regulates what he does, and establishes his priorities of attention and action.

He constantly is faced with the prob-

lems created by conflicting claims on his time and attention, from inside and outside his area of responsibility. If he cannot select properly, he will be slowed down to a walk and over-burdened with the demands originating from many sources. One problem is the individual who tries to attract attention by continually talking to the boss about things he should take care of himself. A test of subordinate management is in its selection of the subjects brought to superiors for discussion or decision.

Every executive must reserve to himself the right to determine the priorities of attention and action. His success and the success of the business can be related to his proper selection of the issues needing attention, and whether the time is now or later.

Certainly the selection of the product, the plant and its equipment, the processes of business or manufacture, has a direct and important contribution to success. But the selection of people is the most important.

In the final analysis, the success of product, plant, and process always turns on the selection of the people who give life and productive value to physical assets. The principal tool of management is the ability to assess the values, the possibilities, and the uses of men in terms of the fundamentals on which the future of the business depends. Without it, everything physical tends to lose its value; the organization fails to move or, if it moves at all, does so ineffectively or way below its capacity.

Superior Personnel Surmount Even A Poor System

The vitality of a business and its competitive strength come from the ability of its executives and related personnel to provide what is needed to ensure progress. Physical components can be improved or replaced fairly easily by the expenditure of dollars, but the dollars are attracted by the capacity of individuals to use them wisely and profitably. A superior personnel minimizes all other problems and sparks above the average accomplishment. A good man can produce good results despite a poor system, and the best system never will be an adequate substitute for a good man. Policies and systems are used not only to direct and channel the operating thought and performance of an organization, but to extend the qualities of management to the much larger number of the less experienced and less able. Thus maintaining and constantly improving the quality of management and personnel, at every level, is one of the first fundamentals of a sound business philosophy and of success in management.

Good Leaders Attract Support

The realistic and objective appraisals required to maintain and improve properties and other physical assets are much easier to make than the same decisions about persons in an organization. But these decisions must be made, and making them is one of the most important and sometimes the most unpleasant responsibilities of management. Accepting the standing progress of the business and of the whole group as a basic requirement can lead to difficult decisions in the selection of individuals for management responsibility. The standards become somewhat different. The ability to do the work has to be coupled with every other element related to outstanding performance on the job. This is because the capacity to provide leadership and to attract support and confidence within, as well as outside the business, is an ingredient of its success.

The texts on management and on the evaluation of managers give an almost unending list of qualities which are essential in one degree or another. They comprise almost every possible business virtue and combination of them. Each major requisite is subdivided into innumerable others which are supposed to provide some fraction of the measurement of the overall factor of which they are a part.

Great stress is laid on leadership, on growth capacity, and on personality factors which include appearance, manner, and the ability to deal successfully with others. The recommended formulas and tests for management capacity are intricate and not always conclusive. At best these only can be guides or helps to selection in an effort to avoid the most easily made mistakes. The problem can be simplified if it is thought of in terms of the individual qualities which contribute substantial plus values to the business, above and beyond the routine requirements of the job.

I think this can be summed up best in terms of its practical application. It is inevitable in practice that when a choice is to be made for an executive appointment — and service, experience, knowledge, and ability are relatively equal—the plus factors of the individual will greatly influence the decision. The higher you go in business or management, the more important these personal plus factors become. It is no accident that these qualities make successful executives outstanding as a group, and as individuals in any group.

Another aspect of selectivity is timing. Decisions can be made at the wrong time and under the wrong circumstances; and timing can be as wrong in minor decisions as in critical decisions. Poor timing makes difficult decisions more difficult and sometimes will defeat the expected result. I have never known any successful manager who did not have a well developed sense of the importance of timing.

Successful Executives Simplify Problems

If you have had an opportunity to observe successful executives in action, I am sure you were impressed by their capacity to reduce complicated subjects, proposals, or discussions to their simplest terms. This is another kind of selectivity. Entirely too often someone has to scrape off the barnacles and push aside the seaweed which collect on a problem or proposal. Unfortunately there are too many persons who encrust simple things with complications or drape a subject with a protective covering of their own special inclinations. When they get through, the real issue has been obscured or lost.

Frequently this stems from an idea that a good answer must bear some unmistakable personal imprint. Then the main objective is confused in the conflict of personalities attempting to dominate the conclusion. Discussions are delayed by individuals anxious to display detailed knowledge unnecessary to resolving the issue. The manager then has to define the problem in simple, understandable terms which can lead to a clear-cut decision. In other words, he has to put to work an unusual facility for grasping and holding up to clear sight the real issue, no matter in what amount of verbiage it has been buried.

This situation is illustrated by a story told me by one of our foremost economists. After he left the university, his first job was with a large nationally-known enterprise. One day the president called him in and gave him a problem

to analyze, and you can imagine how hard he worked on this assignment. Finally he completed his report and, with a good deal of satisfaction, took it to the president.

As he told the story to me, the president picked up the report and flipped over the pages without reading them until he came to the last page, on which our economist had summed up a series of reasons for and against the project. He looked this over quickly, flipped the report back together, handed it to the economist and said, "Young man, take this away and bring me back one good reason." My friend said that from then on he became one of that rare species —a practical economist.

Don't Insult A Man's Intelligence

When dealing with experienced members of a board of directors, or a manager, or a management group, it is unnecessary to prove how thorough you are or how much you know. That usually is taken for granted, if you are good enough to hold the position you do. It is not necessary to educate men of this type by going through every step of your mental processes. By the time the second step is reached, the experienced man is way ahead, looking for the issue, and probably bored and resentful.

The practical rule is a simple one; state the problem or the proposition first—then, as concisely as possible, give the reasons for or against it, and the recommendation. Be sure the comments include the essential facts and cover the issues sure to be raised. If properly done, nothing more may be necessary. Let any further information be requested. In this way what is needed to make a decision becomes available and no one will be bogged down with unnecessary details. Put a high value on the other man's time. He puts a high value on his time and he thinks you should value yours.

Finally, neither men nor businesses stand still. They move forward or backward. Even if they think they are holding their own and are not sliding downhill, some other individual or business is moving up, or moving past. If there is to be progress, there must be motion, and motion comes from decision and action. Without it, there is drift. Frequently it is forgotten that failure to decide and to act is a decision not to do so. The penalties for not making any decision at all can be as great as those for making the wrong decision.

The complexities of modern business and of the economy itself create an unending series of difficulties and frustrations. Recently, management has become an activity of dealing with almost daily emergencies; but difficulties make opportunities.

If you talk to the top executives of any of our representative enterprises, you will learn that the need for better management and the scarcity of it, through every level of the businesses, are their principal concerns. Today there are few businesses which are not beset with management problems, and there are few which can not be benefited by better management. Expansion in size, diversification of products, dispersion of production, growing competition, and the change from a seller's to a buyer's market have placed heavier and heavier burdens on management. In many instances the kind of management needed today has not been developed and its source does not exist, internally. Then management is imported or obtained by consolidation or purchase of an enterprise that has it.

Avoid Unnecessary Details; Value The Other Man's Time

This is why I believe there never was a time in our history when there were more opportunities for individuals with the required attitudes, capacities, and abilities. The possibilities are magnified because we have been passing through an era in which the lazy, the selfish, the improvident, and the incompetent have been encouraged to believe they have not only a vested interest in their jobs and in promotion, but in a certain job, at a certain price, and in a certain place.

Inadequacy and indifference have been too well paid, and too well protected. But the result is that the force of the competition of this growing group has declined; and the man with the abilities, the right attitudes, and the growth capacities is more easily apparent to those who need him.

Certainly management is no place to rest. It is no place for the man who hesitates to tackle tough problems or to deal with complicated issues. It has become a highly specialized task. Those who can be successful as managers of any part of business are in great demand. As Professor Schell, of the Massachusetts Institute of Technology, expresses it—The work of management is like that of a "juggler who, at the height of his skill, has many balls in the air, constantly challenging his ability to maintain their whirl." END

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PHILIP RAUCH left Lehigh University during his 20th year, in 1931, to take over the family business upon the death of his father. From 1932-35 he continued his studies at New York University's evening classes, officiating as president of Ideal Corporation during the day. His company has grown to over 25 times its size when Mr. Rauch took charge. He is a member of the Society for Advancement of Management.

Small Business And Scientific Management

Philip Rauch, President
Ideal Corporation
Brooklyn, N. Y.

Many small business men believe that scientific management is a luxury that only Big Business can afford. In this case history the president of a small business explains step by step how scientific management became an integral part of his company. Starting on a limited scale with a survey of personnel aptitudes, he gradually redesigned his organization, reduced executive turnover, installed a training program for hard-to-get labor, developed an effective wage incentive system. The result was an amazing increase in growth.

THE term scientific management sounds complicated and many people think it's a luxury that only big business can afford. According to the definition I like to use no business can afford to be without it. Scientific management is a conscious, orderly human approach to the performance of management responsibilities as contrasted with the day-in-day-out rule of thumb, hit-or-miss approach.

In our company we use many of the modern management tools and are very satisfied with the results. I feel that small companies must take advantage of these techniques if they hope to compete with big business. However, systems must be simple, practical, and geared to the needs of the individual small business.

Thoreau once said, "I wouldn't talk as much about myself if I knew anyone else as well." Since I am going to tell you what we have done with scientific management in Ideal Corporation, I feel it essential to give you some background about our company.

We manufacture hose clamps, automotive switches and ignition parts. Our line consists of 300 items all of which are considered as shelf goods. Therefore, it is essential that we maintain adequate stocks of all items since back orders are expensive and must be avoided to maintain profits and good customer relations.

Our principal activity is metal stamping and assembly. We purchase components such as screw machine, plastic and bakelite parts, rivets, screws and nuts. It sounds simple; however some of our assemblies are quite complicated. For example, our voltage regulator consists of three electro magnetic relays and contains over 200 component parts.

We employ 250 people. Our products are sold nationally and internationally. On V-J day our business was 90% war work and 10% civilian; today it is 90% civilian and 10% defense work. More than 90% of our current sales consist of items which were developed by our company since the end of World War II.

Our experience with modern management tools was not planned. We got into trouble first and then we developed our solutions. In most cases it was a matter of applying techniques which were new to us but were old practices in bigger companies. Since we have had our share of troubles over the years, we have become acquainted with many of the modern management methods.

In 1947 our plant was organized; we had a strike and wound up with a union shop. We felt badly about this situation because we had many employees with long years of service and since we were paying good wages and had provided most of the benefits found in union shops. Therefore, we thought there must be something wrong with these people.

To find out we called in a psychologist. After we told him what our problem was he said, "When there's trouble at the bottom there's usually trouble at the top." That was quite a shock.

After considerable discussion we decided to give aptitude and psychological tests to all of our employees. To set a good example for our organization we started at the top with our president and worked down to the bottom, our janitor. After we had all been tested, management received the test results. For the first time in the history of our company we had a manpower inventory. While we knew many of the facts stated, these reports gave us information that we didn't know about our employees and confirmed some of the intangible ideas we had about them.

All very interesting, but what to do about it? We had reports that were negative on executives who had positions of

responsibility and had been with the company for years. We just couldn't tell these men that the psychologist thought they were incompetent and that they should have never been put in their present positions. Therefore, our problem was to convince ourselves that the psychologist was right.

Test Reports Check On-the-job Performance

As situations arose we stopped rationalizing about people. We began to correlate our reports with the performance of our men and we began to think objectively about them, to take action when required. Wherever possible we tried to save our men; however, if nothing could be done we had to face the facts and take the action required. It was a tough job but it just had to be done if the company was going to make progress.

Now that it's all over, I can say that it worked out well for the company, and for most of the men. Many were misplaced in our organization and have since gone into other companies where they are doing well because of a different job or environment.

As time went on we hired new men, promoted, transferred and replaced old men. One of our problems was to determine the type of organization we wanted. Since most of the men in our company had been working with me for years we had developed some bad habits. I was used to giving the orders and my associates were following them. Actually I was running a one man show and didn't even know it.

As time went on I recognized that I had to change the nature of my job in order to create an atmosphere that would attract and hold capable men. Instead of giving orders I had to learn to delegate authority and responsibility. Once this was done we were able to separate the wheat from the chaff. In four years we had a 200% turnover in our executive staff. Now that's not par for the course.

One of the principal reasons for this high turnover was due to the fact that we didn't know what kind of an organization we wanted and the type of people we wanted. This was something that only time could determine because as jobs changed the type of people required changed. As time went on our organization stabilized and we began to follow the formal organization chart instead of the informal one. We also learned more about selection and the psychologist learned more about us. As a result our executive turnover has been reduced to less than 5% per year.

Our organization developed to such a point that we had to expand in order to provide opportunity for advancement of the young men in our company. To do this we bought out one of our competitors in 1950 and in 1953 we purchased another company to expand into a new field.

While selection is important, it is only the first step in management development. The second step is training. Actually our company is a training institution. On-the-job training is most important; however, it is not adequate in itself. We provide our supervisors, college trainees and tool-maker's apprentices with an opportunity to take evening courses at the local colleges. The tuition is paid by the company if their grades are satisfactory, and the course has been approved by management. In addition, we provide special training programs within our company. We have held classes in supervision, time and motion study, operator instruction, role-playing, and group appraisal.

To give you an example of results, I should like to tell you about our program for toolmaker's apprentices. For years we were short of toolmakers and went into the open market trying to steal them from other companies. In 1948 we started our apprentice program and now we have an adequate number of toolmakers, most of whom were trained in our own plant.

Local Schools Provide Apprentice Tool-makers

The local technical high schools send us some of their better graduates at the end of each school year. We give these applicants aptitude and psychological tests and pick the cream of the crop. These young men are trained for four years in the various phases to tool-making during which time they take engineering courses selected by management at night. Provided their work is satisfactory in our plant and in college, they are deferred from military service for the period of their apprenticeship. Since our program is six years old we now have a number of men in our plant and in the military services for whom we have plans for development as toolroom foremen, manufacturing engineers and production supervisors. At present our tool design is being done by one of our former apprentices.

It is company policy to hold a group appraisal on all supervisory employees once a year. By means of this technique we obtain the opinion of a man's supervisor as well as that of others who have had an opportunity to observe the men.

The purpose of the group appraisal is to help the man that is being appraised do a better job. Many times a supervisor is too close to his men to get an impartial view which is necessary for him to think objectively about his men.

Developing People Is Number One Activity

One of the by-products of group appraisal is the fact that the men who participate have the opportunity to see the problems that exist in other departments. By so doing they often learn by the failures of others not to make the same mistakes in their own department. For this reason we feel that the group appraisal technique is a good management development tool.

In our organization we have paid considerable attention to our personnel program since it is our philosophy that management is getting things done through people. While we have made a lot of mistakes, we feel the progress our company had made was due to its people. Therefore, we plan to continue to make people our number one activity.

Now I am going to tell you about our production problems in the post war period. It was a seller's market; yet we didn't have much to sell because our production was inadequate. Although our manufacturing methods were good, our output was low. When we started to measure the productivity of each worker, we found we were getting about 50% of standard as an average. Our supervisors used this information to increase the productivity of the employees with low efficiencies. As a result we were able to raise our output up to 75% of standard. We then installed a wage incentive system in 1947 and paid for production above 100%. Our plant is now operating at an average efficiency of 125%. See Schedule A. (On following page.)

Since we were able to increase our production by 150% by means of our incentive system, we were able to expand our business by 150% without any capital investment. By operating a smaller plant we require less supervision and this saving alone has more than offset

the cost of establishing and maintaining our incentive system.

Some of the advantages we obtained from the wage incentive system are as follows:

1. Management is forced to spell out exactly what each employee is supposed to do and exactly how the operation will be performed. This results in a known labor cost per operation.

2. Each operator goes into business for himself. He has the maximum inducement to greater production, improving his earnings by his action alone.

3. The operators put pressure on indirect labor and management in order to get efficient production. This results in putting pressure on production from the bottom up instead of top down.

We use the Work Factor System of measured time values. It involves more work and requires better time study men, but the results justify the effort. It forces the standards engineer to make a motion analysis of each operation. Thus, idle time on a poor work arrangement is pointed out to the tool engineer before the operation gets into the shop. This is much better than having operators find a better method and beating the standard.

To show the efficiency of our direct labor, we issue a weekly production report for each department and the plant as a whole. It compares actual hours versus standard hours and represents our production efficiency. While this report is issued on a weekly basis, each department head is given a daily report, by noontime, covering the previous day's production. We have found it most important to get this information into the plant promptly so that the supervisors can follow the jobs giving trouble.

Measure Extra Costs Besides Production Efficiency

Our Production Efficiency Report also measures extra costs and the items which are included are as follows:

1. Production below standard due to operator inefficiency.
2. Production below standard due to conditions beyond control of operator.
3. Repairs made on defective production.
4. Lost time.

All these extra costs are added and measured against the total standard hours produced. This percentage represents our extra production costs over standard.

Schedule A
Production Efficiency vs. Standard

125% ..... With Wage Incentive
100% ..... Time Study Standard
75% ..... With Work Measurement
50% .... Without Work Measurement
25%

Schedule B

Cause of Variance	Before Report % Standard Hours Produced	After Report % Standard Hours Produced
Operator Below Guaranty	9%	3%
Beyond Operator Control	15%	5%
Repairs	6%	3%
Lost Time	5%	1%
Total Extra Costs	35%	12%

Schedule C
Indirect Labor (I.L.) vs. Direct Labor (D.L.)

	Without Work Measurement	With Work Measurement	With Wage Incentive
Actual I.L. Hours	100	100	100
Actual D.L. Hours	100	100	100
Std. D.L. Hours Produced	50	75	125
% I.L. vs. Actual D.L.	100%	100%	100%
% I.L. vs. Standard D.L.	200%	133%	80%

Experience has shown us that it is just as important to measure extra costs as well as production efficiency. This is due to the fact that a department that is concentrating on production can neglect costs and quality. If the extra costs are not measured, they can be lost in the shuffle. See Schedule B.

Indirect labor is becoming a very important factor in manufacturing operations since the amount required increases as operations become more complicated. Thus it becomes more important than ever to measure indirect labor costs. Since it is difficult in small plants to establish standards due to the varied nature of indirect labor, we measure it against direct labor hours. While this is not a perfect measure, it has enabled us over a period of years to establish standards based on historical records and to keep indirect labor costs under control. It is important to measure indirect labor hours against standard direct labor hours produced rather than actual hours. See Schedule C.

Years ago we had all kinds of trouble between sales and production. Sales claimed that production was always out of stock on the items that were selling and production claimed that sales was not selling what we had in stock. The reason for this was that production was based on past sales. Thus we were operating in the past instead of the future. To overcome this difficulty, we made sales responsible for providing a sales forecast. This is done monthly on our popular items and quarterly on the unpopular numbers. An analysis of our sales showed that 25% of our items represented 75% of our sales. Thus by maintaining close control on a limited number of items, we are able to control the bulk of our production.

Since sales is familiar with business conditions, competitive situations and new markets, they are in a position to tell what should happen rather than having production tell sales what has happened. Furthermore, since sales has assumed the responsibility for telling production what to make, they have also assumed the responsibility for selling what they forecast. As a result of this arrangement many of the problems that existed between sales and production have been eliminated.

Inventory Policy Keyed To Variations In Sales

We used to have a very simple inventory policy since we carried 90 days stock of all raw materials. This policy worked when our line was small; however as our line grew we reached a point where we couldn't find space to store our inventory or money to pay for it. We made an analysis of our material consumption for one year and found that our purchases varied from less than $100 to over $100,000 per year per item. Then we realized that we had to develop an inventory policy that made allowances for the wide variations in consumption. Upon completion of our inventory analysis we decided to maintain a 30 day inventory on all items where our consumption exceeded $10,000 per year. Since this is a small stock and inasmuch as we do have weekly variations in sales, we must control the inventory of these items closely and do this weekly.

On items where our consumption is less than $10,000 per year, our inventory varies from two months to twelve months and the amount of inventory carried is determined by the economic purchase quantity and economic production lot.

With our new system we found that our inventory on under $10,000 per year items increased from 90 to 120 days average. Under the old system this represented 25% of the total and under the new system 33%.

Our inventory on our $10,000 per year items was reduced from 90 to 30 days. Under the old system this represented 75% of the total and under the new system 25%.

Thus by changing our inventory policy and system we were able to reduce our inventory by 42%. This enabled us to improve our working capital position and release warehouse space for manufacturing purposes. See Schedule D.

During World War II the government made us use statistical quality control against our will. After our organization had mastered this technique, we decided to use it on all of our production. Quality control has given us the following benefits:

1. Rejects have been reduced.
2. Repairs have been reduced.
3. Since our production workers participate in sampling, they take more pride in their work.
4. Weekly performance charts are posted in each department which makes employees conscious of quality.
5. Management knows the quality of its product and can have confidence in it.

In our attempt to take advantage of big business methods we installed a punch card office system in our Accounts Receivable, Accounts Payable, Invoicing, Production Control and Inventory Control and Sales Analysis. Our operating policies had to be changed to accommodate the requirements of this system. It was so inflexible that it became our master instead of our servant. Reports came out long after they had served their usefulness.

When it became clear that for our application the system was too complicated, we reviewed our situation and concluded that we had made an error and went back to manual record keeping. However, before making the switch, we reviewed our needs and developed a new system that was up to date with our current requirements.

At present we are handling a volume that is 75% in excess of what we had when we operated our punch card system. Our payroll for this operation has not increased and we are no longer paying a rental fee of $1500 per month. With our current system our records are coming out on time, and we are providing the controls required for effective management.

The experience of our company with modern management methods was mostly by trial and error. When we got ourselves in trouble, we usually recognized the danger signal and did something about it. The ability to recognize danger signals is most important since you can't afford to make the same mistake twice. Your batting average must be over .500 or you won't survive.

From our experience we have learned that most of our mistakes were due to our failure to plan. We were always involved in operating problems and there were all kinds of fires to be put out. We were running on a day to day basis and were concentrating on fire-fighting rather than fire prevention.

Schedule D.
Comparison of Inventory Investment

Old System	New System
ITEMS OVER $10,000 YEAR 75% $ VALUE 90 DAYS STOCK	REDUCTION IN INVENTORY 42% $ VALUE
	ITEMS OVER $10,000 YEAR 25% $ VALUE 30 DAYS STOCK
ITEMS UNDER $10,000 YEAR 25% $ VALUE 90 DAYS STOCK	ITEMS UNDER $10,000 YEAR 33 $ VALUE 120 DAYS STOCK

Planning is now our No. 1 project. It is being started at the top and passed down the line. Right now we have plans to double our business within the next three years. This is no secret and our whole organization knows our goal.

While our plans are not complete, they have been outlined in broad principles covering our new products, production facilities and organization. We are now in the process of developing the details and time schedules for our plans. I know that despite all our planning we will make our share of mistakes. Nevertheless, I am confident that we will fare much better since we are looking ahead instead of back.

The progress which we made with modern management tools was due in part to the management consultants that worked with us. They showed us the way that was followed by others and inspired us to give some of their techniques a trial.

In a small business it is easy to become smug and ingrown. Therefore, it is important to have an outside influence keep you on the right course. Many times management needs something that the staff is not capable of creating. In cases like this, small business can supplement its staff with a consultant and is then able to take advantage of the management tools used by big business.

In using consultants we are guided by several principles:

1. We make arrangements only with men who are specialists and masters of some skill which we require. The best is none too good.
2. We work closely with these consultants so that the program developed is mutual and is acceptable to our organization.
3. We provide for a transfer of skill from the consultant to our staff by making the consultant responsible for training.
4. We provide a follow up by the consultant with our staff to see that the program can be carried out.
5. We are using specialized consultants in the following areas:
   A. General Management
   B. Personnel
   C. Office Methods and Procedures
   D. Industrial Design
   E. Design Engineering
   F. Electrical Engineering
   G. Time and Motion Study
   H. Quality Control
   I. Advertising
   J. Taxes

The introduction of any new management tool requires sponsorship by top management, not lip service. If top brass isn't behind a project, everyone down the line knows it and it's doomed to failure.

Flexibility is a requirement for the introduction of any new technique. This is a characteristic which is rarely found in big business. Small companies can make use of this advantage by teaming up their staff with good management consultants to develop techniques required to suit their individual needs. In my opinion there is no reason why small business can't take advantage of the scientific management tools that helped make big business big. END

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PROCEEDINGS
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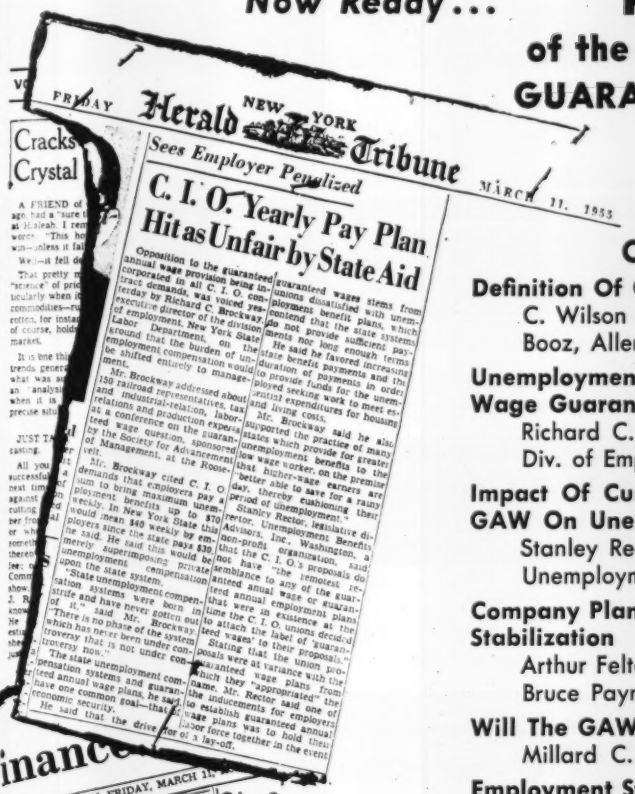

FRIDAY NEW YORK Herald Tribune MARCH 11, 1955

Cracks Crystal

Sees Employer Penalized

C. I. O. Yearly Pay Plan Hit as Unfair by State Aid

Opposition to the guaranteed annual wage provision being incorporated in all C. I. O. contract demands was voiced yesterday by Richard C. Brockway, executive director of the division of employment, New York State Labor Department, on the ground that the burden of unemployment compensation would be shifted entirely to management.

Mr. Brockway addressed about 150 railroad representatives, labor and industrial-relation, labor-relations and production experts at a conference on the guaranteed wage question, sponsored by the Society for Advancement of Management, at the Roosevelt.

Mr. Brockway cited C. I. O. demands that employers pay a sum to bring maximum unemployment benefits up to $70 weekly. In New York State this would mean $40 weekly by employers since the state pays only $30 weekly. He said this would be merely superimposing private unemployment compensation upon the state system.

"State unemployment compensation systems were born in strife and have never gotten out of it," said Mr. Brockway. "There is no phase of the system which has never been under controversy that is not under controversy now."

The state unemployment compensation systems and guaranteed annual wage plans, he said, have one common goal—that of economic security.

He said that the drive for a guaranteed wage stems from unions dissatisfied with unemployment benefit plans, which contend that the state systems do not provide sufficient payments nor long enough terms. He said he favored increasing the duration of payments and the state benefits payments in order to provide funds for the unemployed seeking work to meet essential expenditures for housing and living costs.

Mr. Brockway said he also supported the practice of many states which provide for merit rating of employers' unemployment benefits to the effect that higher-wage earners are better able to save for a rainy day, thereby cushioning their low wage worker, on the premise period of unemployment.

Stanley Rector, legislative director, Unemployment Benefits Advisors, Inc., Washington, a non-profit organization, said that the C. I. O.'s proposals do not have "the remotest semblance to any of the guaranteed annual wage or guaranteed annual employment plans that were in existence at the time the C. I. O. unions decided to attach the label of guaranteed wages' to their proposals." Stating that the union proposals were at variance with the guaranteed wage plans from which they "appropriated" the name, Mr. Rector said the inducements for employers to establish guaranteed annual wage plans was to hold their labor force together in the event of a lay-off.

TELEGRAM AND SUN, FRIDAY, MARCH 11, 1955

UAW Strike Seen For Annual Wage

The United Auto Workers will strike this year over the guaranteed annual wage issue, Frank Rising, of the Automotive Parts Manufacturers Assn., predicted today at a conference on the problem.

He sees small and marginal firms bankrupted if the drive is successful and the larger auto makers forced into cartels with consequent price inflation and standardization of cars.

Richard C. Brockway of the Unemployment Division of the N. Y. State Labor Department was incorrectly reported yesterday to be opposed to the CIO plan, addressing the Society for Advancement of Management conference.

Mr. Brockway pointed out today that he merely outlined existing provisions for jobless compensation in the state and guaranteed wage plans and the area. He was erroneously reported to have said CIO demands included jobless benefits up to $70 a week. He declared that, on such an issue as guaranteed annual wage he, as a state official, would not take a position, nor would the Labor Department.

FRIDAY NEW YORK Herald Tribune MARCH 12, 1955

Brockway Denies Wage Plan Stand

By The Associated Press

In its story yesterday on the conference on the guaranteed annual wage question, sponsored by the Society for the Advancement of Management, the Associated Press incorrectly described Richard C. Brockway, executive director of the division of employment of the State Labor Department, opposition to the C. I. O.'s guaranteed annual wage plan.

Mr. Brockway pointed out today that in Thursday's address to the conference he merely outlined existing provisions for unemployment compensation in New York State and guaranteed wage plans which have been advanced in the state.

The story also inadvertently ascribed to Mr. Brockway a statement that the C. I. O.'s demands include unemployment maximum benefits up to $70 weekly.

Mr. Brockway pointed out today that on such an issue as a guaranteed annual wage, he, as a state government representative, would not take a position, nor would the State Labor Department.

THE NEW YORK TIMES, FRIDAY, MARCH 11, 1955

QUICK LAW URGED FOR ANNUAL WAGE

Sudden enactment of the guaranteed annual wage as an economic law was suggested yesterday as the only feasible approach to the problem.

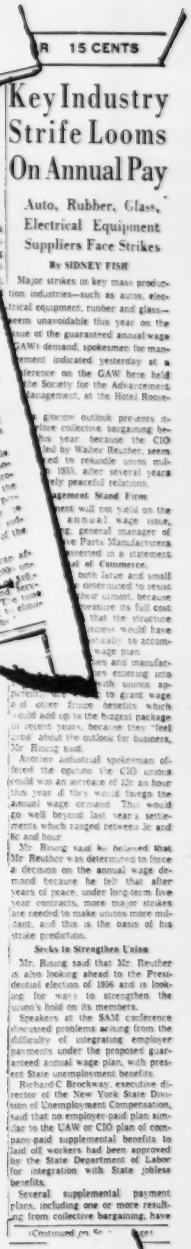
Millard C. Faught, a public relations counselor, made the proposal at the opening of a two-day conference of the Society for the Advancement of Management at the Roosevelt Hotel.

He and David Lasser, research director for the International Union of Electrical Workers, C. I. O., discussed "Will the G. A. W. Stabilize Employment."

Mr. Faught told the 100 representatives of management that wage earners, boards of directors and Congressional committees "would like more economic predictability" but that there was little point in guaranteeing security to only a small section of the economy.

Acceptance by the automobile industry of the guaranteed annual wage, he said, might provide leverage for extending the plan to other industries, but perhaps the answer would be legislate it into existence as an economic law of the land.

"The nation no longer can afford the luxury of [illegible] unemployment while [illegible] 100 days' supply of goods and services," Mr. Lasser said. "To continue [illegible] is the cause," he declared, "of the insecurity of jobs."


R 15 CENTS

Key Industry Strife Looms On Annual Pay

Auto, Rubber, Glass, Electrical Equipment Suppliers Face Strikes

By SIDNEY FISH

Major strikes in key mass production industries—such as autos, electrical equipment, rubber and glass—seem unavoidable this year on the issue of the guaranteed annual wage (GAW) demand, spokesmen for management indicated yesterday at a conference on the GAW here held by the Society for the Advancement of Management, at the Hotel Roosevelt.

A gloomy outlook presents itself for more collective bargaining because this year because the CIO unions, led by Walter Reuther, seem determined to rekindle unions militancy of 1936-37, after several years of relatively peaceful relations.

Management Stand Firm

Management will not yield on the issue of the annual wage issue, declared a general manager of one of the Parts Manufacturers Association, interviewed on a statement by Millard C. Faught, of Commerce.

Mr. Faught, both large and small companies are determined to resist the union demand, because the issue is one of such magnitude that the structure of business would have to be drastically altered to accommodate the wage plan.

Many employers and manufacturers entering into negotiations with unions appear determined to grant wage increases of about 5 cents an hour, which would add up to the biggest package in recent years, because they "feel great about the outlook for business," Mr. Rising said.

Another industrial spokesman offered the opinion the CIO unions could win an increase of 10c an hour this year if they would forego the annual wage demand. This would go well beyond last year's settlements which ranged between 3c and 8c and hour.

Mr. Rising said he believed that Mr. Reuther was determined to force a decision on the annual wage demand because he felt that after years of peace, under long-term five-year contracts, more major strikes are needed to make unions militant, and this is the basis of his strike prediction.

Seeks to Strengthen Union

Mr. Rising said that Mr. Reuther is also looking ahead to the Presidential election of 1956 and is looking for ways to strengthen the union's hold on its members.

Speakers at the SAM conference discussed problems arising from the difficulty of integrating employer payments under the proposed guaranteed annual wage plan, with present State unemployment benefits.

Richard C Brockway, executive director of the New York State Division of Unemployment Compensation, said that no employer-paid plan similar to the UAW or CIO plan of company-paid supplemental benefits to laid off workers had been approved by the State Department of Labor for integration with State jobless benefits.

Several supplemental payment plans, including one or more resulting from collective bargaining, have

(Continued on Page

THE NEW YORK TIMES, SATURDAY, MARCH 12, 1955

STRIKE IS FEARED ON ANNUAL WAGE

Auto Executive Says Union Is Ready to Back Up Its 'Revolutionary Threat'

The automotive industry is facing a turbulent year because of union demands for a guaranteed annual wage, an industry spokesman declared yesterday.

Frank Rising, general manager of the Automotive Parts Manufacturing Association of Detroit, made this forecast at the closing session of a two-day conference on the annual wage issue called by the Society for the Advancement of Management.

Mr. Rising told 100 management representatives at the Roosevelt Hotel that the union-supported plans for attaining uninterrupted year-round employment during seasonal layoffs were "a revolutionary threat" that "just about the most determined [illegible] had wide-reaching we have faced in many years."

He said the plan was not "just mean more jobs," but that it [illegible] another round" of wage increases "won't buy bread and milk this year" or "a bluff" or "a bit of union propaganda."

"I do not expect the management answers to satisfy the union negotiators," he said. "I believe the union wants a strike [illegible] a big strike" and a great and resounding "victory" by forceful, militant action.

Mr. Rising said he believed the United Automobile Workers wanted the strike demonstration, because, "wrong unions get into trouble only by being militant and can only stay that way by being militant."

He declared that if a guaranteed annual wage were "forced" on the automobile industry it would shortly bankrupt many smaller and marginal companies and would force the largest ones into a monopoly, dependent for survival entirely on Government supervision."

The speaker challenged the union's assertions that automation was making an annual wage necessary goal. He maintained that automation had increased the jobs and employment had risen from 233,000 in 1940 to 550,000 [illegible] at the present time.

John Dillon, education representative of the automobile workers, replied from the floor that his union recognized that automation would eventually have a [illegible] period.

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Hiram S. Hall, Labor Relations Consultant

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WROE ALDERSON'S wide experience has included the job of Business Specialist in the Department of Commerce, Market Analyst for the Curtis Publishing Company, Economist for the Board of Economic Warfare, and since 1953 he has been a Visiting Professor at the Massachusetts Institute of Technology. He is the author of numerous books and articles on marketing and market organization.

Operations Research And Management Problems

By Wroe Alderson
Visiting Professor
Massachusetts Institute
Of Technology

In order to apply Operations Research to management problems one must be familiar with the specific techniques of OR and with broad types of management problems. This article describes the basic techniques of Operations Research and explains the types of management problems each technique has been applied to. The author also demonstrates how OR clarifies and reduces managerial uncertainty enough to enable sound decision-making.

A NEW TOOL of management, known as operations research, is exciting interest in many companies. Some executives have been sufficiently convinced of the value of this new approach to set up operations research units. Others remain skeptical as to whether it really represents anything new or are genuinely perplexed as to its practical applications for them. The illustrations of the successful use of operations research seem far removed from business operations. Many of the practitioners of these new techniques have had little contact with management problems. An attempt will be made here to place operations research in a perspective compatible with a management view of operating problems. The examples of potential application will largely pertain to the marketing function. The same plan of evaluation could be extended to problems of production and finance.

It may be helpful to start out by showing how operations research in marketing is related to marketing research and statistical analysis. All endeavor to assist in solving management problems but with a difference in emphasis. The elements of problem solving are facts, findings and recommendations. Marketing research has specialized on the collection of marketing facts through surveys or other procedures. Statistics aid the analyst in deriving valid findings from the facts. His findings include estimates of market potential and measurement of the results of selling effort. Interest in operations research is focused on recommendations. Furthermore, this interest is definitely channeled by a particular conception of what a problem is and the form that a recommendation should take. A problem for the operations researcher is a question concerning efficiency or productivity in some operating system. An acceptable solution takes the form of a rule of action for getting the best results. The goal is the same as in conventional economics but the approach is different. Operations research in marketing, which might also be called operational economics, goes after numerical results which can be useful in the given situation. The methods it employs in finding these numbers are drawn from many branches of science and mathematics. Yet the resulting rule of action can often be stated and applied as simply as the rule of thumb which it replaces.

An executive with a problem is an individual responsible for decision and beset with uncertainty as to the course of action to follow. To solve a problem is to reduce uncertainty to a point that will permit a choice to be made. There are at least four levels of uncertainty which can readily be distinguished in characterizing management problems. Many of the new techniques associated with operations research can be sorted out in relation to these four types of uncertainty in management. What follows is not presented as an exhaustive review of operations research techniques. Rather, it is intended to show how some of its most characteristic methods can be utilized in the problem solving or decision making process. The elements of uncertainty in the four broad types of management problems pertain respectively to allocation of effort, control and coordination, information and contact, competitive strategy and value theory. Each of these areas and the applications of operations research will be discussed in turn.

Allocating marketing effort is the same thing as selecting a marketing program. Like any other economic activity marketing can be described in terms of inputs and outputs. The desired out-

puts are the sales of the company's products projected over the next operating period and are often set forth in a sales budget or schedule of market forecasts. The inputs are the various kinds of marketing effort such as selling, advertising and sales promotion. In discussing the programming problem it is assumed that the market forecasts can be taken as reliable despite the possible actions of competitors. Unexpected shifts in demand are also ruled out for the time being. A further assumption is that the program, once established, will be kept under effective control and produce results as anticipated.

Programming Marketing Activities a Problem

The point is that the programming problem remains even with all these favorable assumptions and is often exceedingly difficult. The source of the difficulty is largely the complexity of the operating processes involved. That means that there is a large number of possible programs, and the analytical task of picking the right one is formidable. The most tangible achievements to date are in physical operations such as warehousing which are the aspects of marketing most closely resembling manufacturing. The warehouse expert controls cost by minimizing the movement of goods required in storage and order filling. One step in accomplishing the result is to arrange products along the assembly line in accordance with Zipf's principle of least effort. That is to say that the greater the number of pieces or pounds to be moved the closer the item is kept to the loading dock. Operational analysis in warehousing produces other benefits beyond the proper positioning of products. It prepares the way for efficient use of mechanical handling equipment and accounting machines and for the functional design of warehouses.

Operational analysis is making headway in other aspects of marketing. Requirements as to the number and size of trucks for a delivery operation have been determined by balancing the cost of movement over the road against the cost of waiting time. Principles of layout for display in retail stores rest on a balancing of the traffic created by a product against its response to traffic created by other products. Some excellent work has been done both theoretically and practically on store location and urban land values, but the opportunity is wide open for the development of more precise optimization formulas in this field.

Much of economic discussion centers on the optimum allocation of effort or resources. The analytical tool favored for this purpose by economists is marginal productivity analysis. Essentially this means that each type of effort should presumably be used up to the point where the last dollar spent in each of these directions is equally productive. There are cases in marketing where excellent results can be obtained by this method used in conjunction with multiple correlation analysis. Management is not always free to make marginal adjustments in marketing any more than in manufacturing. Most types of effort should be maintained at some minimum level or dropped altogether. Some methods or channels are directly incompatible and cannot be used together. These and other restrictions on marginal analysis are equivalent to saying that many operations have a structure which sets limits to the number of feasible programs.

Linear Programming Versus Trial-and-Error Method

Here lies the opportunity for a developing aspect of operations research known as activity analysis or linear programming. No attempt will be made to describe these methods but only to say in simple words what they are intended to do. Linear programming sets out to identify the most favorable among the feasible programs or ways of combining the possible activities or processes in a system of action. Starting with any given program the method enables the analyst to find a more productive one if it exists, then a still better one and so on. This may sound like a rather advanced form of trial and error but it is distinctly superior to informal trial and error with no reliable means of weighing one plan against another.

There are serious computational difficulties in the more complicated programming problems. However, it frequently turns out to be an aid to insight to set up the problem in this form. In this connection an attempt to apply linear programming may revitalize some of the older and more conventional analytical procedures. Sales analysis and distribution cost analysis in skillful hands can still lead to marked improvements in marketing operations. They might acquire a new significance if regarded as means for obtaining the parameters needed for carrying out linear programming. It might equally well turn out that linear programming would provide a conceptual framework giving point and direction to the older types of analysis. Operations research in its very nature embraces any existing method that can help solve a problem rather than introducing a new one purely for the sake of technical virtuosity.

Control and Coordination in Marketing Systems

In the second class of problems, as in the first, the aim of the operations researcher is to find an appropriate optimization formula. That is to say that he is offering analytical help to management in mimimizing costs, maximizing results or identifying the best possible pattern of activities in a complex operation. The chief difference is that the discussion from here on must take account of further factors of uncertainty. In the first case uncertainty for management was largely the result of complexity and not of contingency with respect to control of the problem situation. In this section we drop the assumption that management is dealing with a well-oiled machine. The individuals or organization units involved in the operation are recognized to the semi-independent but are susceptible to management. That is to say that they are willing to be coordinated to the extent that there is a common interest in results. The best means of control and coordination may become the key management problem. In the view of Chester Barnard, the function of the executive in large organizations is not to engage directly in maximizing behavior but to keep the or-organization tuned up so that it will operate at an optimum level.

The techniques of operations research can assist management in coping with uncertainty at this level as well as in programming and allocation. This particular phase of operational analysis is called control and communication theory. In one of its versions it has been given the name cybernetics which freely translated is "steersmanship." The mathematics of the field have been developed by such diverse specialists as neurologists and electrical engineers. But while cybernetics has made a substantial contribution to an understand-

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If not, see page 8.

ing of servo-mechanisms and of the nervous system, applications to operating organizations are only in the beginning stages. A central principle of control is called negative feed-back. That means that when the operation moves beyond the control limits the information is fed back along appropriate channels so that correcting action can be taken. Human systems of communication and control are subject to difficulties similar to those of mechanical systems. The message may be obscured by noise or interference. There is frequent danger of overloading the channel. The channel may fail because it is not a closed circuit. The feed-back may produce over-compensation so that the system oscillates further and further out of control.

Model of Cooperation Includes Data Feedback

None of the purely mechanical models quite comes to grips with the basic process and motivation of human cooperation. It should be readily possible to extend the theory as soon as the issues have ben clearly drawn. In a cooperative setting each individual performs a specialized function on the expectation that other individuals will be performing related functions and the total program will proceed in a satisfactory manner. The performance of each participant depends in part on his confidence in the performance of others. Often one participant must have definite knowledge of the action of the other in order to proceed with his action. One may be responsible for initiation of action and another for detailed execution of action.

The elementary model of cooperation would consist of two participants with the action of each conditioned in some degree by a feedback of information about actions taken by the other. The study of such models might be extended step by step to take account of larger cooperative systems. That type of model has already been employed in studies of the inventory problem. The coordination of any sequence of steps or the balancing of production and selling activities is a problem of this general character. After the parameters of control have been established by operations research it may be possible to design electronic devices or other mechanical means to facilitate coordination.

Another type of study in this area is that directed toward improving an organization structure to permit more effective cooperation. One of the techniques of operations research is the operational experiment. This means setting up a probability model which has a structure paralleling an actual or potential operation and then putting it through an operating cycle. Thus, in a situation involving a waiting line of units to be serviced, the arrival of units on a random basis over time can be simulated by pulling numbers from a table of random numbers. The capacity required to maintain a given standard of service can be estimated in this way. Because of the relatively low cost of securing data by these so-called Monte Carlo methods it will be possible to try out several alternative patterns of operation on paper before putting any one plan to the final test of action. One of the side advantages of such a procedure is that of minimizing the number of adjustments which have to be made after a plan is put into effect and which can have a very adverse effect on morale. One important field of application would appear to be in the management of marketing channels. Any new policy may tend to favor one type of customer to the dissatisfaction of others, so that damage is done either by changing it or by attempting to hold the line. There is a high premium in such cases on being approximately right the first time, a result which might be achieved more readily by using operational models.

Search Theory and The Problem of Closure

The first section proceeds on the assumption that the operation to be programmed is fully controlled. The second section drops this assumption to take account of cases in which the problem of control is crucial to the system of action. In this third section we drop the assumption that management is dealing initially with a closed system. The crucial problem then becomes that of achieving a sufficient degree of closure to permit an operation to be completed. A supplier searching for customers is able to market his goods only to the extent that he make successful contact. A buyer searching for goods is similarly seeking to effect the closure in the system which is necessary to the continuity of the processes in which the goods are to be used. Problems of control and of programming may remain to be solved but they are naturally subordinated in many cases to the primary problem of contact and closure.

Shopping Behavior Studied With Probability Models

The probability models required for this phase of operational analysis can be derived from what is known as search theory. To do this the analyst must proceed in terms of basic conceptions and not rely on superficial analogies. In physical terms there is very little resemblance betwen a plane sweeping over miles of ocean looking for submarines and a consumer examining retail assortments looking for a dress. The basic similarity is that both must be guided by some sort of a priori estimate of the probabilities of finding what they want. These probability estimates may undergo change in the course of the search, but from moment to moment may affect decisions as to where to look and whether to break off the search or continue. Work now being done on consumer shopping behavior is making use of such probability models and appears to be yielding significant results. The study of actual shopping trips in turn has led to the development of psychological tests having the same probability structure as shopping. In these tests it is possible to control and to modify the parameters and to gather data much more rapidly and economically than could be done through collecting further data on actual shopping trips.

In seeking to establish contact with customers the marketing organization is trying to reduce uncertainty by achieving operating closure. This function can be performed with greater assurance if the seller takes account of the dimensions of uncertainty confronting the buyer. One objective of every supplier is to induce a certain number of customers to buy with confidence and to regard him as their regular source of supply. At the same time the supplier who endeavors to expand his position in the market must attract some customers who are

MOVING?

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habitually buying from his competitors. To do this he may undertake to plant doubts in their minds and may be said to be increasing the degree of uncertainty they experience. However, if he has a legitimate claim upon their attention he may simply be making them aware of actual hazards in their situation and suggesting that his product can help solve their problems. There is no necessary conflict of interests here since consumers, like persons playing any other economic role, may have to be made aware of problems before they can undertake to solve them. It is believed that operational analysis of this type can have an impact on many aspects of marketing, including advertising and retail assortments and display.

Problems of Competition And Conflict

In all of the previous sections, with their varying assumptions as to closure or control, the discussion pertains to an operating system in which there is some community of interest among the participants. In this final section the reality of conflicting interests is recognized. Conflict may exist between organizations or within an organization. External conflict is typified by competition among large scale enterprises. It is among large companies that management can conceive of marketing strategies and in turn must take account of the strategies of their competitors. An effective strategy often takes advantage of some special character of the firm which employs it and may be difficult to counter in precisely the same terms. Competitors may not have a good answer available and are able only to choose strategies which tend to minimize the degree of competitive injury suffered. A firm may be forced to employ purely defensive means for some time until it finally matures a plan of counter attack which makes use of its own natural advantages. In intensively competitive industries there may be observed an ebb and flow of competitive advantage not unlike a succession of military battles or campaigns.

The division of operations research which can provide models for this type of competition is game theory. In some games there is a point of balance between the players representing the worst that can happen to the stronger competitor and the best that can be achieved by the weaker one. That kind of stable adjustment has been reached among large competitors in many instances. Game theory also provides models for competitive situations without this type of stability. Game theorists are working actively toward the consruction of models which can stimulate a greater range of competitive situations with greater fidelity. Some applications have already been made in business and accelerated use can be expected as the theory progresses. There is no substitute for managerial experience and resourcefulness in devising or meeting competitive strategists but an orderly framework for evaluating possibilities is useful to the sharpest competitors.

There are a number of economists and operations researchers who are attempting to cope with conflict of values within an organization. Schemes have been devised for rating objectives and working toward a point of compromise by successive trials. Conflict of values affects many types of economic activities starting with household purchases. There are doubtless many families lacking anything approaching a stable expenditure budget because of the lack of agreement on basic family goals. These tensions with respect to family requirements may often reflect still deeper tensions including basic conflicts within the individual personality.

Conflicts Often Resolved By Appeal To Broader Criteria

The resolution of conflicts can range over into the areas of ethics and psychiatry but they are not thereby excluded from the interests of the operations researcher. He may properly take on the assignment of finding a procedure for resolving conflicts within an operating system if that is the crucial problem which is interfering with productivity. Conflicts at one level of consideration are sometimes resolved by appealing to criteria pertaining to some broader level. Conflicting goals in a single organization unit may have to be resolved in terms of the aims of the whole organization. Conflict in short range objectives may be reconsidered in terms of long range objectives. Some conflicts cannot be resolved at all within the existing frame of reference. Management must decide when to fight and when to seek constructive compromise. The analysis of the factors involved in the conflict is therefore an appropriate topic for operations research. END

A National Materials Handling Week

Extension of remarks of Hon. Peter W. Rodino, Jr., of New Jersey, in the House of Representatives on Tuesday, January 11, 1955.

Mr. Speaker, I wish to direct my remarks in behalf of my resolution proclaiming a National Materials Handling Week . . . The American Society of Mechanical Engineers has a division devoted exclusively to materials handling, as does the Society for the Advancement of Management.

With the increasing interest in materials handling, it became evident that a national organization composed of local chapters was needed. So, in January 1949 steps were taken to form the American Materials Handling Society, Inc. . . . Since 1949 the society has grown to 34 chapters in the United States, from coast to coast, and 5 chapters in Canada . . .

Because materials handling is so basic to our whole economy, the economy of the greatest manufacturing country the world has ever known, the 4,000 members of this growing society and myself urge the enactment of this special legislation setting aside a "National Materials Handling Week" — a week to pay tribute to the man who pushes the wheelbarrow and to all the men who contribute to our vast production lines. Each one of them is doing his share in making our life more comfortable and secure in peacetime, and giving us greater protection in wartime. . . .

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Time Study
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Hugh A. Bogle
SAM
General
Chairman

Upon his graduation from the University of Tennessee in 1929, with a degree of B.S. in Dh.E., Mr. Bogle went to work for the du Pont Company and has been with them ever since. His early years with the du Pont Company were spent in research and production work. Since 1944 he has been doing consulting work in the Central Engineering Department. He was recently made Assistant Manager of the Management Engineering Section.

Harry M. Kaiser
SAM Member

Mr. Kaiser is Staff Department Manager of the Tire Division at the United States Rubber Company. He went to the U. S. Rubber Company in 1930, beginning in the industrial engineering department of one of their footwear plants in Indiana. A former member of the Taylor Society, Mr. Kaiser has continued to take an active interest in the affairs of its successor, the Society for the Advancement of Management. He is a former member of the Detroit Chapter, is now with the New York Chapter. He is also a member of the National Office Management Association.

Bruno A. Moski
SAM Member

Since graduating from Yale in 1927, with a degree in Industrial Engineering, Mr. Moski has had extensive experience in industrial engineering and plant management with Western Electric, Sperry Gyroscope, Sargent, Colt Fire Arms and American Paper Goods. He went to Yale and Towne in 1950. He is now Director of Industrial Engineering in the Yale Materials Handling Division of Yale & Towne Manufacturing Company. He has taught Industrial Management at Seton Hall College, E. S. M. W. T. program at Yale University and Drexel Institute of Technology. Mr. Moski is president of the Philadelphia SAM chapter and a member of the Philadelphia Chamber of Commerce.

THE forthcoming Time Study and Methods Conference (April 28, 29, H Statler, New York City) will mark the tenth annual staging of this a which is co-sponsored nationally by the Society for Advancement of Manage and the Management Division, American Society of Mechanical Engineers the period of a decade this Conference has become a traditional event. Its im on the growth and improvement of industrial management, here and abroad. been considerable. Many executives have come to regard this Conference as start of their "new year" for planning new improvements in production t niques, work measurement and labor relations.

This year's program fittingly notes the anniversary aspect of the event. speakers include men who not only are present-day leaders in their specia but have also been trail-blazers in industrial management for many years p The text books, monographs, articles and speeches of these men would fill sev five-foot shelves of management literature.

True to tradition, the program stresses the newest and most practical in t study and methods. The theme this year is "Retooling Management for Com tition." A more appropriate theme for current consideration by manage would be difficult to imagine. Whereas nothing is happening to change the b ground rules of wholesome, ethical competition in business, there are, ne theless, concrete developments whose impact on the competitor may prove d and lasting within a very short time. Such developments include the follow

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Mr. Schoeller has been a Management Consultant, Job Counselor, Visiting Lecturer and Faculty member at the Wharton School since 1947. Prior to that year he worked for the American Home Products Corporation, the Western Electric Company, the Research Machine & Tool Company and for the Sherwin Furniture Company. He is the author of numerous articles on management, and his forthcoming book entitled *Office Work Simplification and Management* will soon be published by McGraw-Hill.

Oliver J. Siz
SAM Membe

Professor Sizelove, Professor of Ma ment at Newark (New Jersey) Colle Engineering, has been with that s since 1936, teaching Industrial Eng ing and Personnel in both Graduate Undergraduate School. Since 1940 h been acting as consultant to Manage and Arbitration with A.A.A., and the Jersey State Board of Medicine. B beginning his teaching career Mr. Si worked with the Diehl Manufact Company as an Industrial Engineer with the Kolster Radio Corporation.

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The rapid progress of automation in manufacturing processes and materials handling.
The processing and feed-back of manufacturing data through high-speed, electronic computers.
Modified thinking on tariff regulations.
A peacetime economy gearing itself to the exigencies of a shooting war.
Heightened selectivity in the buying habits of the public.
A rising rate of company mergers.
Growing debate on the guaranteed annual wage.
Expanding concepts of community responsibility in managerial thinking.

These are but a few of the shifting patterns whose movement and impact put bold, new challenges to the ingenuity of all levels of supervision in ay's management. As is almost always the case, the impact will be first and dest at the points where better products are expected to be made at less to both the maker and the consumer, and with optimum skill, enthusiasm d good will on the part of the working force.

This year's Conference is structured to suggest concrete preparation for morrow's bold challenges. The very latest and best infomation is presented in following areas: production management; industrial engineering technique; or relations; materials handling; cost control; master planning; and com-nity management.

Frederick W. Hornbruch, Jr.
ASME General Chairman

Currently Mr. Hornbruch is Chief Engineer of Rath & Strong, Boston. With an M. E. Degree he went from Stevens Institute of Technology in 1934 to Weston Electrical Instrument Corporation in the Design and Development Engineering department. His next job was with Falstrom Company as Time Study and Methods Engineer. He went to Bendix Aviation Corporation as Industrial Engineer, and Columbia Machine Works as Production Manager. Mr. Hornbruch is past president and chairman of the board of SAM Philadelphia Chapter, and a member of the executive committee of ASME Management Division.

Robert F. Mendler
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Mr. Mendler has been with The New York Air Brake Company since 1949, after receiving a B.S. in Industrial Engineering from Lehigh University where he enrolled in 1946 after serving in the Naval Reserve from 1940-46. Since going to the Air Brake Company Mr. Mendler has served as Assistant Methods Engineer, Interdivisional Sub-Contract Coordinator, Assistant to the Chief Industrial Engineer. Currently he is Supervisor of the Time Standards Department.

Matthew J. Murphy
ASME Member

Mr. Murphy has been editor of FACTORY since 1953, was associate editor of the magazine for two years before being made editor. From 1940-46 he was Assistant Vice President of Abraham & Straus, Brooklyn, N. Y.; from 1935-40 he was Personnel Manager and Training and Research Director of Bendix Radio. Before going into business Mr. Murphy was an Instructor and Assistant Professor at the School of Commerce, New York University. He is the author of numerous articles on personnel and production management, executive development and related topics.

Size lliam R. Swett
mber M Member

Swett began his business career in 6 with the Firestone Tire and Rubber mpany. He is now Vice President and ector of Bruce Payne and Associates, , and has been consultant to companies industries dealing with mining, steel, tal trades, electronics, textile, paper, amic and graphic arts. Mr. Swett has tured at the University of Connecticut management. He is a National Director the Society for Advancement of Man-ment.

Edward R. Murphy
ASME Member

Mr. Murphy is Plant Manager of the American Can Company, Newark, N. J. He became chief tool and die designer and assistant chief designer of machines before promotion to his present position. He is a member and past chairman of Northern New Jersey's Chapter 14 of the American Society of Tool Engineers and a member of the executive committee of Technical Societies Council, and is presently secretary of Management Division, American Society of Mechanical Engineers.

RICHARD MUTHER, a former Assistant Professor at Massachusetts Institute of Technology, has also taught management at Robert College in Istanbul, Turkey, and at the U. S. Navy's Management and Industrial Engineering School. A recognized authority in the field of plant layout, he is the author of "Production-Line Technique," "Practical Plant Layout" and numerous articles and technical papers. Mr. Muther is a member of the Society for Advancement of Management.

Managing The Plant Layout Function

By Richard Muther
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Most of the literature on the subject of plant layout deals with techniques of how to make a layout. The basic management decisions that initiate a change in layout and the human problems that go with installing a new layout are ignored by most writers. This article discusses plant layout from the management viewpoint. It answers these fundamental questions: How much attention should be devoted to plant layout? When is it time to change? How can a layout change build morale?

PLANT LAYOUT is a management responsibility. True, much of the fact gathering, analysis and installation are delegated to the layout specialist, but fundamentally even the top management of a plant can hardly afford not to be interested in the arrangement of its plant facilities.

A friend in Europe made this very clear. His plant had been partially bombed during the war. In requesting reconstruction funds from his stockholders he proposed to rebuild exactly as the former arrangement had been. A suggestion on a minor detail started him thinking—made him realize the potentialities of a full-scale study. He ended up with a fine layout, and three years later was even more enthusiastic than at first. "My original decision to rebuild exactly as before," he told me, "was not prompted by urgency. I just failed to recognize layout as one of my responsibilities." Then he added, "Let's hope it doesn't take another bombing to get us to study our layout again."

You think this an exception perhaps. But, it is not. Top management, composed of persons who have not at some time had supervision of production operations, material handling, or methods work, simply fail to see the significance of proper facilities arrangement. They are usually more interested in the design of the building from an appearance standpoint.

One plant manager asked me to help plan a layout for his proposed new building. He showed me only the overall floor plan dimensions. I recognized immediately that they were not satisfactory for his operation and began to question him about these building plans. Then he admitted the building had actually been erected five years earlier. "And at the time" he added apologetically, "the building was given a distinguished award for its architectural design."

Does this mean that every plant must keep a full-time staff of plant-layout engineers? Absolutely not. The manager of a cotton gin, a flour mill, or an oil refinery needs to devote relatively little attention to layout compared with the manufacturer of electrical appliances, automobiles, or clocks. For these latter companies, layout is a constantly recurring problem.

The underlying factors that determine the degree of management interest—at least from an operating standpoint—are shown in the table on the next page.

This does not mean that layout can be neglected in plants with expensive processes and a complex of permanent machinery. However, most of the layout worries in such cases are concentrated in the very beginning. This is the time when the plans are being developed for the entire project: process, machinery, layout, and buildings. And it is a time when major decisions regarding layout are to be made; after the buildings are constructed and the equipment is hooked up, the layout will not readily be changed. Therefore, management must be sure it places adequate stress on layout during the early critical planning period.

Where products are constantly being redesigned and processes are changing frequently, the layout is constantly being readjusted. And where production volume is also high, plant layout — as with process engineering, tool and equipment-planning, and installation work — becomes a rather tightly scheduled activity. Usually relayouts of this kind are under the pressure of production schedules made weeks earlier.

This article is adapted from the author's latest book, PRACTICAL PLANT LAYOUT (McGraw-Hill Book Co., N. Y., 1955).

The most logical time for a change in layout is when making improvements in process, methods, and equipment. Methods changes and improvements in machinery and equipment go hand in hand. And since good layouts are planned basically around the machinery and equipment, they in turn are based on the process and methods. As a result, whenever a layout project is in the offing, processes and methods should be reappraised. And whenever new methods and machinery are being planned, it may be a good time to re-evaluate the layout.

Management Activities Related To Re-layout

Managements often overlook other opportunities or possibilities related to layout. Here are a few such items:

1. A layout change affords an opportunity to get rid of a lot of bad habits. The area involved is going to be changed around or relocated; a major physical change will be made. Here is an ideal time to sweep clean, to break with traditions, to shake off any bad practices. A company should take advantage of this fresh start to streamline the operation of the area involved.

2. A layout change may be made in order to permit reorganization or modified procedure. A change in supervision, in the inspection procedure, or in the method of ordering material may actually be what is needed and wanted. By making a relayout, the desired changes can be made a necessary part of it.

3. Sometimes layout changes are assumed—or wishfully thought—to be the entire solution to a costly problem. At one plant there had always been congestion in a basic department. The new layout just installed was functioning no better than the previous arrangement. The consultant called in to check on a proposed third layout pointed out the real cause of the problem: limited machine capacity on critical operations and lack of proper production scheduling.

4. A layout change gives management the opportunity to change a lot of things it may have wanted to do but had been holding back. One company had grown into the unnecessary practice of having two men on each lift truck. This had long been a source of great expense. The new layout overcame the problem when truck operations were replaced by a monorail conveyor. Later, lift trucks we reintroduced in other areas with everyone in agreement that it was not desirable to have them manned by two men.

More than any others, there are two features about layout that frequently go unrealized. These are the elements in all layouts of compromise and of visualization.

Like every management decision, there is some element of *compromise* in each layout. The purely ideal layout is seldom practical; there is no such thing as a perfect layout. Some aspect of the layout must be sacrificed for the overall solution, and that solution is never 100% satisfactory to all groups. Therefore, the end result can always be attacked or challenged by someone, when looking strictly from one point of view. It will save much time and effort if both management and layout specialists understand this.

Clear *visualization* is vital. The layout specialist and the manager alike must be able to understand clearly what is planned and how the actual installation will look. Many techniques are used to attain this clear visualization. But, sometimes we misinterpret techniques. For example, a chief executive once told me, "We want to develop a three dimensional model of our layout and do this the modern way." It's not a question of being modern, or of using 3-D models because they are "colorful" or "fun." or of "buying" a layout because it is prettied-up. We use visualization aids to help plan clearly and to help others see what has been planned.

Overseeing a Layout Project

Managements thoroughly experienced with the problems of organizing and controlling plant layout projects have learned much that tends to insure success. The following points or advice cover some of this "Insurance."

1. *Appoint a Group or Individual as Head of the Layout Project*

In many instances the layout of an industrial plant is left in the hands of

HOW CONTINUOUS A PROJECT IS PLANT LAYOUT*

TYPE OF LAYOUT ACTIVITY IN RELATION TO:	A. Plants requiring *major attention before* initial installation but *little or no layout analysis after* installation	B. Plants requiring *periodic or irregular layout attention*	C. Plants requiring *more-or-less continuous attention* to layout problems
PROCESS OR METHODS	Where basic methods or process are expected to remain unchanged during the life of the plant	Where occasional improvements in process or changes in methods are anticipated	Where frequent process and methods changes—both minor and major—are expected
MACHINERY AND EQUIPMENT	Where installed machinery and equipment — including that used for production, handling, storage and service—is very lasting, very expensive, and very fixed or costly to move	Where machinery and equipment is moderately durable, expensive, and fairly difficult to move	Where machinery and equipment is short-lived, inexpensive, and easily moved
PRODUCTS AND MATERIALS	Where products and materials are not subject to change for long periods of time	Where products and materials are occasionally or irregularly changed	Where products and materials change frequently
PLANT BUILDINGS	Where plant buildings are less permanent than the process, equipment and "life" of the products	Where the plant buildings are about as permanent as the process, equipment and products	Where the plant buildings are more permanent than the process, equipment, and "life" of the products

* From PRACTICAL PLANT LAYOUT, McGraw-Hill Book Company

the production manager or supervisor of the particular area of the plant involved. When this is done, busy operating people are loaded with additional duties. They cannot easily find time to make the necessary studies and analyses that underlie a sound layout. And they propably are not acquainted with the fundamentals and latest techniques of layout planning. As a result, it is usually more advantageous to place this work in the hands of a specific layout group. The group may consist of only one man on a part-time basis or in larger plants, a department of several engineers with adequate assistance.

With the responsibility fixed, the project can be planned, scheduled, and supervised readily. Now the individual supervisor and all others interested in the new layout can bring their points of view to a trained specialist who actually does the detail work of planning the new layout, who gathers and evaluates the facts, who sifts and weighs all ideas contributed, and who is in a position to build the cooperation so essential to a successful layout.

For the manager who feels that his plant is too small to justify a specialist, the following alternatives are possible.

A. *Assign the project to a committee* of various people closest to the layout. This is practical when the project involves relayouts of a minor nature. It can be a valuable way to boost interest in plant improvements. However, a committee requires close supervision, is slow in action, and often merely gathers together a lot of opinions and draws up a plan without objective analysis.

B. *Employ an outside specialist.* Consultants can place at your disposal a man trained in layout work and with broad experience. For the firm that has an occasional major layout job, this is frequently the best answer.

C. *Develop layout engineers from within the firm.* This is generally done by selecting a man within the organization and making him, at first, the head of minor layout projects. He should be encouraged to study the available books and magazines covering the field. One of the best types of training is to have him work on one or two projects right along with a layout specialist brought in to handle the assignment.

D. *Plant visits to other companies.* Visits to similar, though not necessarily competing, companies can be a real stimulus. And the new developments that come from the cross-fertilization of ideas in discussions between the personnel of different firms is so often little short of amazing. However, one must beware of becoming sold on a system that is not applicable to his condition, merely because it has worked well for somebody else.

2. *Supervise the Layout Work as Necessary*

The easiest way to supervise any layout project is to be sure the group responsible is following the guiding fundamentals of good layout. These include:

(1) Plan the whole and then the de-details
(2) Plan the ideal and from it the practical
(3) Follow the cycles of layout development and make the phases overlap
(4) Plan the process and machinery around the material requirements
(5) Plan the layout around the process and machinery
(6) Plan the building around the layout(s)
(7) Plan with the aid of clear visualization
(8) Plan with the help of others
(9) Check the layout
(10) Sell the layout plan

By checking to make sure the layout engineer or group is following these fundamentals, a manager can normally keep himself out of the details.

In giving out a layout assignment, a manager should make a *clear statement* of the project, even though it is at first only exploratory. It is important also, to give the layout engineer information about the plans and policies of the company that will affect the layout — new products, inventory policy, decentralization and the like.

When the assignment is understood by the layout engineer, a *schedule of the project* should be made. This not only spells out the steps to be taken; it allows the manager to coordinate other work with the layout project. This is of course vital on jobs where the layout is only part of a larger project of building construction, product design changes, machinery and equipment procurement, material purchases, and hiring and training personnel. But even when the layout job involves a minor relayout in an existing plant, a schedule of steps to be taken should be made and periodic checks of progress posted against it.

Certainly the manager should request *a check of progress* as each phase of the layout work nears completion. Otherwise he is in no position to determine whether costs of the layout proposed are getting out of hand, whether all departments are being consulted and are cooperating, and whether the layout engineers are informed on and understand any new management views that might affect the layout.

There are basically four phases of work in every plant layout project. A manager should review progress in at least these four places.

Review Phase I (Location)
When the specific area to be laid out has been determined.

Review Phase II (General Over-all Layout)
When approval is requested for the general over-all layout plan.

Review Phase III (Detailed Layout Plan)
When approval is requested for the detailed layout plan or for each of several detailed plans covering portions of the over-all area.

Review Phase IV (Installation)
When the layout is installed and ready to turn over to operating personnel.

3. *Balance Forcing Accomplishment with Getting Good Results*

A manager will only lose out in the long run if he presses his layout engineers for "some visible plan" too quickly. It is the gathering of facts and making analyses that leads to the right end decision. A manager can best guide his layout men by asking them for a review of the factual data and analyses, thus encouraging a thoroughly sound basis for the layout. If a manager needs something that looks more "tangible" than figures—to show the chairman of the board or for some important visitor —he should realize that he may be delaying his layout project to ask for them too soon.

At the same time, every scrap of fact is not possible to gather and endless re-

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April 30, 1955.....Board of Directors
May 28, 1955.....Executive Committee
June 25, 1955.....Board of Directors

finement is wasteful. There must be action, for time is a part of every decision. The right layout made too late is often no better than a wrong one. Since layout is a compromise, it becomes easy for the layout engineer to debate and discuss and adjust and try out at great length to the detriment of "accomplishment." Most managements recognize that engineers tend to be meticulous and, therefore, are aware that all too often this kind of perfecting the details is the cause of delay. When this occurs, the alternatives should be brought out into the open and sharply evaluated. Management may have to step in and force this in order to get results.

4. *Plan for the Future*

It is hard for some managers to consider the long-range plans of the business. Attention is logically focused on current needs. However, any management approving funds for a new layout should seriously question whether the layout suggested will be as good at the half-way point in its life as it looks at the beginning.

In developing layout plans, the wise manager will call for a planned analysis of anticipated requirements. He will project his sales plans for many years ahead. When an entire site is involved, a minimum "look-ahead" of 25 years is needed. From this, a basic plan can be drawn up for developing the entire area according to a sound over-all layout. The initial building and all subsequent additions can then be integrated into the planned pattern.

5. *Approve the Layout*

Executives or department heads who are asked to approve layout plans normally look at three things:

a. What do we stand to gain from this layout? How much will it reduce our basic costs and will it make our work easier, more convenient and safer?

b. What are the risks in this layout? What could happen to us if certain of the features of the layout went wrong or failed or did not function as planned?

c. How does this layout affect me personally and my group?

With this in mind the manager will certainly want to see analyses of the costs required to install or change layout and of the savings expected. Cost figures will usually be well worked out. But he should watch for hidden costs in terms of increased maintenance, greater demands on service equipment, and the like. Therefore, most managers check to be sure at least three other problems have been covered: safety, convenience for personnel, and changes necessary in organization structure or operating procedures. Layout men who have seldom had real management experience usually place their emphasis on the obvious economies and often overlook one of these major considerations which, if not caught by management, could possibly cost the company more than the tangible savings gained.

There are two ways for management to be sure that all groups agree on the layout: (a) to hold a meeting of all personnel involved to go over the layout plans together and (b) to make sure all department heads, or a given list of them, have initialed the layout plan.

These points are summarized on the accompanying list of "Morale Builders."

MORALE BUILDERS

1. *Tell employees of the anticipated layout improvements.*
2. *Ask employees' help and patience if they are bothered by layout or methods engineers.*
3. *Solicit the ideas of everyone, possibly by special campaign, posters, or suggestion forms.*
4. *Talk enthusiastically about the layout plans and how the new layout will probably benefit everyone.*
5. *Get personnel or industrial relations to indicate how the new layout can benefit employees.*
6. *Invite employees to come in and see the three-dimensional model or post a template layout out in the shop.*
7. *Describe—orally or in writing—how the new layout will work.*
8. *Show workers where their machine, office, or bench will be located.*
9. *Show advance photographs or sketches of new machinery or material-handling and storage equipment.*
10. *See that adequate explanations are given by the layout men to any employees who do not seem entirely satisfied.*
11. *Make available sketches, drawings, plans, or description of the layout that employees can take home with them.*
12. *Write up the progress of the layout project in the company paper.*
13. *Seek at least one good article in the local newspaper.*
14. *Consider magazine articles about the layout.*
15. *Consider an open house for employees' families soon after getting settled.*

Getting a good layout is more or less guaranteed by these methods. But also, there is the important factor of group participation. In the eyes of a department head or supervisor, the layout engineer represents change. And with every change comes fear or apprehension. Much of this can be avoided by building from the start the idea that the layout is a "company" project—a project in which all will be consulted and everyone involved will be given a chance to review and approve the plans. This is especially important when layout changes are not a regular thing, for in these cases the relayout may be the biggest thing that happens to a man's department in his life with the company.

In addition, most people like to be creative; they like to participate in layout work when they see it beginning to take shape. For these reasons, managers frequently kick-off a project by encouraging participation by everyone, and with assurance that everyone involved will be given the opportunity of approving the final plans. When the time for approval comes around, this opportunity should be given—if not required.

On this basis it might at first seem wise to bring every worker in the plant into the development of the layout. Actually this has not proved effective where it has been tried and the reasons are fairly obvious. Yet the bringing of employees into the layout project is important. If handled badly—on a take-it-or-leave-it basis—a new layout can lead to complaints, grievances, labor turnover, general dissatisfaction and even strikes. It is far better to tell the workers that there is to be a new layout that is going to be more effective than the present arrangement they now have to put up with; that anyone who has ideas on making a better layout should turn them in because in the last analysis they are the ones who will have to make the layout work. This should be done before layout engineers or analysts are sent out onto the production floor to measure machines or study methods. Throughout the project management should boost the layout to new employees; selling the layout is one of the fundamentals for successful layout.

Besides these internal activities to build employee enthusiasm, experienced managers know that favorable publicity outside the plant can help swell employees' pride in their plant. One good complimentary article in the local newspaper for every layout change is insisted upon by the industrial-relations department of one company. By activities such as these, managements can turn what might be a potentially disruptive layout change into enthusiastic employee and supervisory satisfaction. END

New Management Writing . . .

INDUSTRIAL CONFLICT

Edited by Arthur Kornhauser, Robert Dubin, and Arthur M. Ross. Published by McGraw-Hill Book Company.

If we were to consider *Industrial Conflict* according to the usual meaning of the term, that is, denoting such *outward* manifestations of industrial strife as strikes and other similar disturbances or disorders coming to the public view, we would necessarily conclude that the publication of this book is poorly timed, occurring as it does during a year generally conceded to be the quietest since the end of World War II. This book, however, answers any criticism of timeliness by dealing with the *inner plant* aspects of individual and group behavior from which the authors deduce, mainly from a psychological, social and economic viewpoint, certain resultant frustrations, disorders and disturbances.

By way of general observation, it is believed fair to say that, from all indices and outward evidences, there is need, particularly in those industries experiencing really poor organic health, for a searching and thorough investigation into not only those basic inner conflicts which are described in this book, but into other aspects of their operations, looking for the real and effective causes. These basic causes, like their symptoms, cannot be treated in a political manner, as is so often the case, and where opportunism and expediency are allowed to rule, but must be met in a more forthright manner—by direct treatment. Viewed in its proper setting and according to its true concept, therefore, the book comes at a most appropriate time.

Fully to appreciate the main thesis, one should first read Arthur Kornhauser's scholarly treatise on human motivations, or the roots of industrial conflict, presented in Chapter 5. While the author seems to drop off into generalizations in his concluding paragraphs, the main body of his thesis is well worth reading. Such expressions as "conduct is an expression of complicated combinations" and "our monsters swim deeper than any of our harpoons will reach" are pregnant with meaning and will serve to evidence the live, original thought which pervades principal sections of this particular contribution. In reading Mr. Kornhauser's psychological essay one must really "drink deep of the Ephesian spring" for just a little knowledge of the complicated motivations of man, impelling him to certain conduct, might well prove to be a very "dangerous thing". A mere cursory reading will not do.

Industrial Conflict is a book which will strike one at first reading as being quite discursive, empiric, highly pedantic and abstruse. However, as one manages to get closer to this unusual subject, he is more and more able to see behind the maze a plan, one which might have well been predicated upon a predesigned system of schematic controls but which in reality allows full expression of some extraordinary talents. The individualities of the many contributing authors are seen through their individual exposition of the substance of their subject matter. One finds a certain fluidity of substance and a form of continuity of intelligence which appears to run through the entire multithesis presentation. The substance is not necessarily new but is clearly illustrative of much of our modern thought and should be given very selective and discriminate study.

Industrial Conflict contains forty chapters all revolving around the stated central theme. These chapters are each individually written by almost as many individual authors, all prominent in their respective fields of pedagogy. While it may seem to the student of industrial relations that here is an experiment in a new form of literary collectivism where the force of numbers lends strength, actually such form of multiple authorship dates back at least as far as The Bible, and the strength is more substantial than mere numbers.

With some of the theses in *Industrial Conflict*, we must quite naturally disagree. Some of this disagreement we shall classify as serious, an occurrence not at all uncommon in the field of industrial relations among proponents of particular and diverse points of view. Our disagreement, however, is constructive and intended solely to clarify and not to harm any particular presentation. At times, differing points of view are developed through individual experiences which have impressed one's thinking and strongly influenced his views over a period of time, compelling him to retain certain conclusions. At other times, particular philosophies are developed, with apparently sound postulates to support, which merely accommodate general practice, irrespective of original concepts and classical distinctions. These are expressions of the "market place". It is with neither of the above built-in inhibitory influences that we find unacceptable certain notions of mediation, even though undoubtedly correctly described as to modern *usage*, and particularly the third-party pressures described in Chapter 22.

Pressure of any kind involves a form of force, which must be clearly outlined as a source of power in constitutional and statutory authority and then circumscribed in its use, to be tolerated at all in our form of democracy. Unless so outlined and circumscribed, force does violence to rights of private citizens and is subversive of our voluntary processes, including collective bargaining, and our free institutions.

One need not be gifted as a Carlyle or Homer these days for adequate expression in describing any adoption of pressure methods, which become meddlesome, being without authority in law, and do violence to established constitutional rights and processes. Somewhat like the spider, the mediator weaves his web out of his own entrails. But he cannot arrogate himself powers not provided by law or the voluntary agreement of the parties. Nor can the mediator usurp power inherent in the legislature, nor exert pressure *contra forma statuti* or, *sua sponte*, exert such pressure as might result in any form of force, however mild.

If we are to avoid industrial conflict we must seek industrial harmony and peace. This requires that both parties, labor and management, seek the same end. There is no middle road to this cherished goal. Without meaning to oversimplify, there is only the right road which leads *toward* the objective, and the wrong road which leads away from it. You cannot travel them both at one and the same time, nor can you, with any degree of safety, straddle both lanes of traffic; both are heavily traveled thoroughfares, and straddling will lead to almost certain conflict and disorder, if you will.

Upon the basic thesis and its underlying tenets and premises, it is recommended that *Industrial Conflict* not only be read, but be given serious and discriminate study by members of management, those aspiring to responsibilities in management, members of the teaching profession and students of industrial relations.

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REVIEWS IN BRIEF

Automatic Selling

By G. R. Schreiber. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 195 pps. $5.00.

This book was written by a man who has helped to pioneer automatic selling during the period of its greatest growth. It is packed with facts and figures on every aspect of automatic merchandising, including many charts and graphs.

Ratios Of Staff To Line Employees And Stages Of Differentiation Of Staff Functions

By Alton W. Baker and Ralph C. Davis. Published by Ohio State University. 62 pps. $1.00.

The findings of this study provide new and more detailed information for the formulation of an empirically valid law of functional growth, suggests simple, practical applications by industrial executives.

Management Aids For Small Business: Annual No. 1

Edited by Edward L. Anthony. Published by Small Business Administration, Washington, D. C. January 1955. 184 pps. Price: 65c.

The subject matter of this group of Aids falls into three classes: business-Government relations, internal general management, and external sources of help, advice, and guidance.

Contributions Of Survey Methods To Economics

By George Katona, L. R. Klein, J. B. Lansing and J. N. Morgan. Published by Columbia University Press. 269 pps. $5.00.

This book represents an attempt to analyze survey results for the benefit and promotion of economic theory. A listing of selected survey findings reported by the Economic Behavior Program is given in the bibliography at the end of the volume.

CIPM Reports . . .

SINCE 1951, CIPM has recruited top-management specialists to conduct seminars in seven countries of Western Europe under the Foreign Operations Administration's Technical Assistance Program. Last September, again under FOA auspices, CIPM sent two teams of four men each to Turkey to conduct a management program in that country's four principal industrial centers. This is how the Turkish program started and how it is working now.

Over a year ago, a member of CIPM's Paris staff went to Turkey, and in cooperation with the FOA mission there, laid the groundwork for a management development program. As a result of this preliminary operation, FOA last year sent a group of management experts to Turkey to work under contract to the Turkish government in surveying the country's management resources. One of this group, Carl Coler (formerly Executive Secretary of SAM) has made an industry-by-industry analysis of industry's training needs; has formed committees of industrialists in Istanbul, Ankara, Izmir and Adana; and recently has been holding training programs in these four cities as a follow-up to the seminars CIPM's top-management team held last October.

The four members of the top-management team led discussions on general management, human relations, production management, and marketing during these seminars. Of interest to SAMers is the fact that two of the members of this team—Lawrence Murphy, Executive Vice President of the Williamson Heater Company in Cincinnati, and Harry Hopkins, Vice President in Charge of Operations of the Tool, Steel, Gear & Pinion Company, also of Cincinnati — are prominent in the SAM chapter there. Mr. Hopkins is past president of the chapter, and Mr. Murphy is one of its directors. These men, plus Saul Silverstein, President of the Rogers Corporation in Manchester, Connecticut, and Harry Southard, Secretary of the M. B. Skinner Company in South Bend, Indiana, spent a week in each of the four Turkish cities discussing management attitudes with local Turkish industrial leaders. The American team members made no attempt to talk to the Turks about specific methods or techniques; they left that job to the four management specialists, also recruited by CIPM, who are now spending a year in Turkey holding three-month courses in each of the four cities visited by the top-management team.

One of these specialists is Martin Doring, Chief Industrial Engineer of the Whitney Blake Company in Hamden, Connecticut, and Vice President of the New Haven SAM. He writes from Izmir, where he and his three colleagues have just completed a three-month training and consulting program:

"Until two weeks ago I saw very little of my work being put into effect. Then one day one of the engineers in my class was absent and I spoke to him about it. He told me that they had put a preventive maintenance program into effect and on that day they were checking the bearings of one of their huge machines, and he had to be in his factory to make the inspection. This, I thought, was amazing because in most cases they run machinery until it breaks down. So to pull down a machine that is running and in production for a routine inspection is an amazing accomplishment." END

The Council for International Progress in Management, formerly the National Management Council, is a non-profit, non-political organization devoted to the promotion of the practice of scientific management on the international level. SAM is a co-founder and charter member of CIPM.

Functional Management

Throughout the whole field of management the military type of organization should be abandoned, and what may be called the "functional type" substituted in its place. "Functional management" consists in so dividing the work of management that each man from the assistant superintendent down shall have as few functions as possible to perform. If practicable the work of each man in the management should be confined to the performance of a single leading function.

Excerpted from SHOP MANAGEMENT by Frederick Taylor.

JOEL DEAN, Professor of Business Economics in the Graduate School of Business, Columbia University, is also a consulting economist to management, a director of the American Hard Rubber Company, the General Precision Equipment Corporation, Technograph Printed Electronics Inc., and the American Marketing Association; a trustee of the Bureau of University Travel, and associate editor of the Journal of Industrial Economics. During World War II he headed the machinery pricing section of the Office of Price Administration. He is the author of a number of books on management problems.

Break-Even Analysis And The Measurement Of Capital Productivity

By Joel Dean
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Of the many complex problems that confront management, the problem of deciding when to invest in plant and equipment is one of the most critical. A poor decision deprives management of capital that could be employed better elsewhere. It also encumbers management with equipment that is difficult to fit into the company's production pattern. In this article a well-known authority writes about break-even analysis, a technique familiar to industrial engineers, and its relation to investment decision-making.

BREAK-EVEN analysis and capital productivity measurement are two new techniques of modern financial management which have been studied and appraised separately. The purpose of this article is to examine the inter-relationship of these two new top management tools.

We shall do this in four steps:

1. Review the meaning of break-even analysis, so that we can be clear about what we are discussing.

2. Summarize the underlying concepts of capital productivity and indicate some of the measurement methods and problems.

3. See what break-even analysis and capital productivity measurement have in common and where they differ.

4. Examine the potentialities and limitations of break-even analysis as a contribution to capital productivity measurement.

What is break-even analysis? In the simple form in which it gained its first popularity, break-even analysis uses a chart on which dollars of total cost and total revenue are related to fluctuations in volume of dollar sales. Total cost and total revenue are shown as straight lines, which cross at the greatly over-emphasized "break-even point". Profit or loss can be read from the chart as the distance between the cost and revenue lines.

Subsequent developments have led to a more realistic portrayal of the behavior of costs and revenues and have broadened the range of problems to which the break-even device can be applied, so that its more enthusiastic proponents can now claim that break-even analysis is a general purpose management tool of nearly unlimited usefulness. One major improvement in the construction of break-even charts has come with the recognition that straight cost and revenue lines sometimes fail to represent the facts clearly. To allow for this, break-even charts have been drawn with curved or stepped lines to represent the relationships between cost or revenue and volume. Another important development has been the presentation on a single chart of families of break-even lines to reflect the impact of additional variables. Along with increased accuracy and flexibility, these refinements have led to corresponding increases in the complexity of the break-even charts themselves, so that it is now recognized that there may often be a conflict between making the charts simple and making them right. For complex, many-variable problems it may be necessary to omit or drastically modify the charts, while retaining the basic break-even approach.

What is capital productivity analysis? Capital productivity analysis or capital budgeting is a set of procedures for choosing, combining and evaluating the facts that are relevant to a capital investment decision. For each proposal an estimate is required of the year-by-year changes in the firm's profit which will result if the proposal is approved. The amounts to be estimated are essentially net cash flows and often require that accounting numbers and accountants' concepts be modified or disregarded.

Similar sets of estimates should be made for all reasonable alternatives, including the oft-overlooked alternative of doing nothing. With the cash flows from the least-cost acceptable alternative as a benchmark, the cash flows from increasingly costly investments are compared to determine their incremen-

For major assistance in preparing this article the author is indebted to Winfield Smith of Joel Dean Associates.

tal cost and profitability. Finally, the year-by-year incremental cash flows for any one alternative are combined using discounting factors which recognize the greater worth to the firm of near cash over distant cash.

When these capital-productivity measurement procedures are consistently applied to all candidates for the firm's limited supply of investable funds, all capital-requiring projects, no matter how diverse, are ranked according to a single, logical standard of investment worth.

Similarities and Differences

Both break-even analysis and capital productivity analysis are concerned with *forecasting profits*. Both concentrate on *total* costs, revenues and profits. And both deal primarily with *changes* in total profits that result from changes in circumstances.

Both are properly concerned with the *functional relationships* between profit and the various factors that determine profits. Knowledge of these basic relationships improves the accuracy of break-even analysis and of capital productivity analysis. Although the way in which this knowlege is used differs, the same common fund of experience and research can be drawn upon.

Break-even analysis like capital productivity measurement, predicts *changes* in total cost and revenue and profit under altered circumstances. Moreover, the principle that behavior of specific cost items depends upon the nature of the costs and of the contemplated change in conditions is basic to both of these methods of analysis. The same can be said about the common emphasis on future costs instead of past costs and the common importance assigned by both kinds of analysis to estimating true changes in total cost rather than changes in allocated book costs. These principles are essential to any correct managerial decision and not merely to the tools discussed here.

The differences are striking. Break-even analysis is most easily applied to predicting the effect on profits of changes in volume, i.e., in rate-of-use of existing capital facilities. Capital productivity analysis, in contrast, estimates the impact on profits of proposed investments to alter or replace existing facilities. Break-even analysis, accordingly, is solely concerned with what *short-run changes* in volume do to costs and revenues and profits. It distinguishes between (a) costs that vary with volume in the short-run and (b) costs that don't. In contrast capital productivity analysis is concerned exclusively with *long-run changes*, i.e., those costs and revenues that will be different if the capital proposal is accepted than if it isn't.

Another difference is that break-even analysis is a *passive* prediction of what will happen to the company's earnings as a result of vast impersonal forces of the market place. In contrast, analysis of capital productivity takes an *active* approach: it seeks ways to make the company's profit be bigger in the future by a proposed investment action.

Break-even analysis, claims to the contrary, notwithstanding, has its greatest value when only a single short-run cost curve must be considered. It helps most when the problem is limited to determining the most profitable rate-of-use of an existing single-purpose facility. Enthusiastic practitioners can get many additional variables onto the charts, but by the time lines have been added representing two or more alternative investments or changes in product-mix the chart has become unintelligible to anyone who does not already comprehend all the underlying relationships: it helps those who don't need help.

The methods of capital productivity measurement, on the other hand, are adaptable to situations involving a multitude of alternatives, since the costs, revenues and profits of each are estimated separately and compared with the least cost benchmark to secure measures of incremental profitablity.

Since capital investment decisions typically require a choice among many alternatives, each with volume units that differ in kind as well as in amount, capital expenditure analysis requires a method which is flexible enough to summarize all the cost, price, and volume variations among the alternatives.

Although break-even analysis highlights the interrelation of volume and profit, it is unable to evaluate the combined effects of predicted variations in amount and timing of cash flows for a long-lived investment. Regardless of whether the unit of analysis is the project's entire operating life or a "typical" year of this life, and despite the inclusion in fixed costs of some form of capital charge, important differences between projects are thus submerged or ignored. Break-even analysis assumes that the investment is made, the project is completed, and the long-run average earning rate is attained, all in an instant; the wide variations that actually occur among projects are in fact too important for most companies to overlook. Capital productivity analysis, through use of a year-by-year timetable of cash flows and application of discount factors to these cash flows, takes correct account of any conceivable variation.

Against the superiority of capital productivity analysis for handling many alternatives and variable cash flows stands the unique ability of break-even analysis to keep attention focused on the importance of volume estimates. In our experience the undeniable importance of volume does not justify using an analytic tool which straightjackets all the other variables in order to preserve the freedom to play with volume estimates right up to the point of final approval or disapproval of the project. At some point, well before final review, it ought to be possible to decide on a reasonable set of estimates of volumes which can be handled, along with the other variables, by the techniques of capital productivity analysis. If a check is needed, the calculations can then be repeated using higher and lower volume estimates spanning the likely range of error; these will indicate the degree to which project acceptance depends upon any particular estimate of project volume.

What Break-Even Analysis Can Contribute to Capital Productivity Measurement

As the foregoing strictures indicate, break-even analysis is generally inferior to the methods of capital productivity analysis in providing a framework in which to arrange and hold all the facts bearing on an investment decision. There are, however, several ways in which the concepts and techniques of break-even analysis can improve capital productivity measures.

First, knowledge of the shapes of cost functions for the firm and for individual operating units can help produce better estimates of the cost functions of proposed units or of present plans after incorporation of proposed investments. Unfortunately, break-even analysis has

not performed the same service for revenue functions. Usually it makes the tacit and erroneous assumption that unit prices, price structures, product-mix, and channel mix are all constant. If volume is measured in sales dollars, then the cost function (which must relate to physical volume) is wrong. If volume is measured in physical terms (e.g. tons or % capacity), then the revenue function is off. In either case this revenue straight-jacket introduces error in the profit forecast.

A second contribution of break-even analysis is to call graphically to executives' attention the width of error-ranges in volume projections and the effect that variations in volume within these ranges can have on profits. This sharpened awareness of the effect of volume on profits heightens appreciation of the importance in capital expenditure studies, of good estimates of future rates of utilization of the facility. Too often costs are estimated with painstaking care and volume estimates are tossed in with inadequate attention to their level or probable range of error. Break-even analysis can help avoid this mistake.

By emphasizing volume fluctuations, break-even analysis can bring home the fact that cyclical and seasonal forces will run volume back and forth over a considerable range. Thus it can contribute to investment analysis by pointing to capacity needs at the top of the range as well as emphasizing the importance of accuracy in forecasting the long-range average volume. Intelligent financial planning requires provision for peak demand by investment or by other means. Earnings on capacity-increasing investments must be figured differently than for cost-saving investments, which produce earnings over the entire volume range. The rate of return on a capacity-increasing investment derives from its superiority over alternative ways of handling the added volume. One of these alternatives (increased overtime, for example) is generally the most profitable solution if the added demand comes only in a short-term peak. In this case the entire return on a capacity-increasing investment comes from its utilization in volume ranges which are on this overtime basis, high cost without the investment. This makes capital productivity more dependent on good estimates of volume than for most cost-saving investments.

Finally graphic presentation of the results of several variables, along the lines of a break-even chart, is frequently useful in the intermediate stages of a capital expenditure study. In one study of a capacity expansion project a chart was drawn showing the sum of labor overtime and weekly minimum payments with and without the proposed investment and covering the expected possible range of output. A year-by-year output forecast was then used together with this chart to make up the timetable of cash flows. Although break-even analysis was not able to handle all the timing variables which had to be taken into account, it was nevertheless useful.

Thus the essential function of break-even analysis in appraisal of capital expenditure proposals is supplementary. It has its primary value in developing a proper attitude toward estimates of the effects of different operating volumes. It can also assist the visualization of projections. This somewhat proscribed usefulness does not mean that the break-even approach should be abandoned in capital expenditure analysis, but it does mean that break-even charts should be used with care and without demanding from them any more than they are capable of delivering. END

AN EXECUTIVE HAS NOTHING TO DO

by F. F. Beirne

As EVERYBODY knows, an executive has practically nothing to do. That is, except to decide what is to be done; to tell somebody to do it; to listen to reasons why it should not be done; why it should be done by somebody else, or why it should be done in a different way; except to follow up to see if the thing has been done, to discover that it has not been done; to listen to excuses from the person who should have done it and did not do it, except to follow up a second time to see if the thing has been done; to discover that it has been done but done incorrectly; to point out how it should have been done; to wonder if it is not time to get rid of a person who cannot do a thing correctly; to reflect that the person in fault has a wife and seven children, except to consider how much simpler and better the thing would have been done had he done it himself in the first place, but to realize that such an idea would strike at the very foundation of the belief of all employees that an executive has nothing to do. . . .

These are contrary but not necessarily conflicting points of view, since few administrators would deny that the top executive is often both master and victim of his organization. What good executive has not experienced the deadening frustration of being unable to get things done the way in which he himself would, but cannot, because of pressure of other responsibilities, limited time, and rapidly moving events? The most capable heads of the most powerful organizations may get caught in the vortex of events beyond the effective grasp of mankind and its mechanisms. Tolstoy (in *War and Peace*) has described how Napoleon in his "victorious defeat" at Borodini in 1812, "with sickly uneasiness awaited the end of this action in which he considered himself the prime mover, though he could not have stopped (it)."

Even when an undertaking is more in tune with historical events, the most capable top executives in charge of the most efficient organizations cannot make all the major decisions. Yet there is often a tendency on the part of executives to try to do this too much, with the result that they get too little done. Despite all the initiative that is latent in American democratic society, Morris Cooke has pointed out (In *The Early Days of Rural Electrification Idea*) that there is still an "excessive and growing dependence on the top of a state, a county commissioner, the head of a union, or the foreman of a road gang." From the point of view of the administrator, one of the main decisions he must learn to make is what to select for decision from the endless demands on his attention and his authority, and what not to decide himself but delegate to others. As Chester Barnard has wisely concluded (In *The Functions of the Executive*), "the executive is primarily concerned with decisions which facilitate or hinder other decisions."

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THEODORE HARITON has long been active in industry in the field of management development, covering supervisory training, executive evaluations, selection and placement and attitude surveys. He has served as a faculty member of the Psychology Department of the University of Michigan, with the Utica-Colgate Counselling Center, at the Kaiser-Frazer Corporation as Special Assistant in Education, with the University of Michigan's Survey Research Center as Study Director.

Executive Selection

Theodore Hariton, Ph. D.
Assistant Director
Industrial Division
Psychological Corporation
New York City

A well-planned Executive Selection Program can be of infinite value to a company. In the hands of skilled personnel, psychological tests can provide much valuable information about the basic abilities and characteristics of the applicant. Moreover, a well-conducted depth interview will provide many of the answers to questions about the individual's personality and motivation.

PRACTICALLY every major company in the United States has a Management or Executive Development Program of some sort. And in most of these programs primary emphasis seems to be placed on the development rather than on the selection of personnel. Still, it is obvious that an efficient selection program can materially improve the caliber of executives in our various organizations. Furthermore, the more capable the employee is to start the less need there is to design elaborate and time-consuming programs for his development. In this sense an ounce of selection is worth a pound of training.

The properly selected employee will absorb training more quickly. In fact, he will in most instances train himself. An able and highly-motivated executive will assume the responsibility for his future growth and will formulate his own program of self-development. For such people the major concern of the company is to make the opportunities for development available.

It is difficult to estimate the cost of a poor selection decision. Even at low levels the company makes a large investment in each employee. But when we consider the investment in executive personnel, the cost is staggering. There is a tremendous difference between the performance of the "marginal executive" (who barely "gets by" and is thus never released) and the performance of the executive who is a real producer. Not only are there selection, training, supervision, and salary costs, but there are the costs which result from poor decisions, lack of imagination and the like.

Let us now direct our attention to the characteristics which are important to success in executive positions—what we look for when selecting executives—as well as the tools which are available for measuring those traits and abilities.

With respect to the selection of executive personnel, it is evident that qualifications essential for successful job performance will vary with the particular position to be filled. This obviously means that a careful study of each job must be made to identify those abilities and personality traits which are required. However, although job specifications for various Managerial positions will differ with respect to the *type* of Qualifications needed, as well as the estimated *degree* of such characteristics, there are certain major *types* of factors which form the hard core of every Managerial job specification. In selecting executives, we should ask ourselves the following questions:

A. *Technical and Ability Factors:* How able is he to handle the job? In this connection, the education, training, and experience of the individual loom important. Is his background applicable to the particular field in question? What of his general training and experience —breadth as well as depth.

Secondly, does the man possess the basic abilities necessary to do the job? How about his over-all mental ability? Does he possess above average intelligence, analytical ability, and imagination? Does he have the necessary special abilities required by the job in question: verbal, numerical, mechanical, and the like.

B. *Interests and Motivation*: How *willing* is he to use his knowledge and abilities? Actually, the performance of a man is the product of his ability and drive; if either factor is zero, the resulting achievement is zero. In the area of motivation are included such factors as willingness to work, willingness to assume responsibility, willingness to pay the price, desire to direct the activities

of others, desire to get ahead, production-mindedness, and self-discipline.

C. *Personality:* How *effective* is he in his relations with people? Basic personality adjustment and emotional stability are two extremely important factors in executive success; without these factors an executive would find it difficult to work under pressure, to take criticism, to control his temper, and to maintain his health. With respect to effective interpersonal relations, it is the warm, friendly, pleasant, outgoing type of person who has least difficulty in managing others. For proper balance, however, he should also be objective or tough-minded in his thinking; considerate without being "wishy-washy." Finally, he should have a clear picture of his assets and liabilities and should recognize when he needs assistance and when he doesn't.

D. *Character:* Is he honest and reliable? The most capable man available is worthless for the job in question if he is not to be trusted. In this area, qualities to be evaluated would include his conscientiousness, his fairness and impartiality, whether or not he has the courage of his convictions, his sincerity, honesty, and loyalty, and finally his moral and ethical standards.

E. *Special or Miscellaneous Factors:* Is there anything else which will materially affect his job performance or progress? Here would fall such questions as his physical vigor and energy, his general appearance, grooming, and manners, his marital adjustment, and his willingness to travel or to make geographical moves of a semi-permanent nature.

Before we move to the measurement of these traits and characteristics, it is necessary to point out that no one individual has all the desirable characteristics. Nor do successful Managers conform to a single pattern. Executives seem to hold and acquire a good many traits in common, but no single "type" underlies these common characteristics. Frankly, if there is any one element common to all executives, it is simply a drive or an underlying strength that enables a man to take whatever characteristics he has and keep going with them. Thus, individuals who differ considerably from each other can still handle the same job well. Many studies of leadership have demonstrated this point.

Several Techniques Needed For A Complete Picture

Measurement of Characteristics: Now that we have considered some of the major factors which are related to executive success, let us look at the tools which are available for measuring these traits and abilities.

First of all, I wish to point out that no selection technique is perfect. Making selection decisions is a very difficult task, and at best we manage to increase the batting average. Moreover, the techniques about to be recommended are obviously not the only effective selection method.

A. *Psychological Tests:* Psychological tests can make an important contribution to executive selection. These tests provide measures of intelligence, verbal and numerical skills, mechanical comprehension, social intelligence, and (in the hands of a skilled psychologist) imagination. Moreover, the test results provide valuable clues which can be followed up in the interview. For example, a person with superior intellect who "just got by" in school, might well be lacking in drive or motivation.

There are serious limitations to psychological tests in the selection situation, however. They provide measures of only a few of the requisite characteristics referred to earlier. In the *selection situation* they tell but little about such factors as personality, character, and drive. Moreover, they provide only limited measures of analytical ability and critical thinking. In general, we would say that such tests alone cannot predict success. On the other hand, though, low scores can suffice to disqualify a man.

B. *Intensive Interview:* As indicated earlier, selection tests do not provide good measures of personality, character, and drive. These factors can be evaluated by means of a carefully conducted intensive or depth interview. In such an interview, the man's whole life history is explored, including his early home background, education and training, work experience, activities and interests, and his aims and goals. Actually, the interview is the most critical part of the selection program since it represents the occasion on which all the information is integrated and the final decision is made. Here *all* the man's major assets and liabilities are weighed in relation to the job in question.

Evaluating executives by means of psychological tests and interviews is a difficult and demanding task. Good interviewing is an art, and few employment interviewers are sufficiently well-trained to conduct thorough evaluations. Thus, before any company attempts to set up a test-interview selection program for high-level executives, it should first make sure that the men who head up the program are well-qualified for the job. END

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Binghamton	Operations Research as Applied to Management Problems	M. Hurni	Management Consultation Div., General Electric Co.	Hotel Arlington	11
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NOTES ON THE THEORY OF ORGANIZATION

by Luther Gulick

IN BUILDING the organization from the bottom up we are confronted by the task of analyzing everything that has to be done and determining in what grouping it can be placed without violating the principle of homogeneity. This is not a simple matter, either practically or theoretically. It will be found that each worker in each position must be characterized by:

1. The major purpose he is serving, such as furnishing water, controlling crime, or conducting education;

2. The process he is using, such as engineering, medicine, carpentry, stenography, statistics, accounting;

3. The persons or things dealt with or served, such as immigrants, veterans, Indians, forests, mines, parks, orphans, farmers, automobiles, or the poor;

4. The place where he renders his service, such as Hawaii, Boston, Washington, the Dust Bowl, Alabama, or Central High School.

Where two men are doing exactly the same work in the same way for the same people at the same place, then the specifications of their jobs will be the same under 1, 2, 3, and 4. All such workers may be easily combined in a single aggregate and supervised together. Their work is homogeneous. But when any of the four items differ, then there must be a selection among the items to determine which shall be given precedence in determining what is and what is not homogeneous and therefore combinable.

A few illustrations may serve to point the problem. Within the City of New York, what shall be done with the doctor who spends all of his time in the public schools examining and attending to children in the Bronx? Shall we (1) say that he is primarily working for the school system and therefore place him under the department of education? (2) say that he is a medical man, and that we will have all physicians in the department of health? (3) say that he is working with children, and that he should therefore be with a youth administration? or (4) say that he is working in the Bronx and must therefore be attached to the Bronx borough president's office? Whichever answer we give will ignore one or the other of the four elements characterizing his work.

Students of administration has long sought a single principle of effective departmentalization just as alchemists sought the philosophers' stone. But they have sought in vain. There is apparently no one most effective system of departmentalism. Each of the four basic systems of organization is intimately related with the other three, because in any enterprise all four elements are present in the doing of the work and are embodied in every individual workman. Each member of the enterprise is working for some major purpose, uses some process, deals with some persons, and serves or works at some place.

If an organization is erected about any one of these four characteristics of work, it becomes immediately necessary to recognize the other characteristics in constructing the secondary and tertiary divisions of the work. For example, a government which is first divided on the basis of place will, in each geographical department, find it necessary to divide by purpose, by process, by clientele, or even again by place; and one divided in the first instance by purpose may well be divided next by process and then by place. While the first or primary division of any enterprise is of very great significance, it must none the less be said that there is no one most effective pattern for determining the priority and order for the introduction of these interdependent principles. It will depend in any case upon the results which are desired at a given time and place.

An organization is a living and dynamic entity. Each activity is born, has its periods of experimental development, of vigorous and stable activity, and, in some cases, of decline. A principle of organization appropriate at one stage may not be appropriate at all during a succeeding stage. In any government various parts of its work will always stand at different stages of their life cycle. It will therefore be found that not all of the activities of any government may be appropriately departmentalized neatly on the basis of a single universal plan. Time is an essential element in the formula.

Another variable is technological development. The invention of machines, the advance of applied science, the rise of new specializations and professions, changes in society and in the way men work and move in their private life must be continually reflected in the work of government, and therefore in the structure of govenment. Before you organize a statistical division there must be statistical machinery and statistical science, but as soon as there are such machinery and science, any large organization which fails to recognize the fact in its organization may greatly lessen its utilization of the newly available tools and skills.

A further variable influencing the structure of any enterprise is its size, measured not so much by the amount of work done as by the number of men at work and their geographical dispersion. . . . Similarly, in government the nature of the organization must be adapted not only to the technological requirements but also to the size of the undertaking and the dispersion of its work.

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